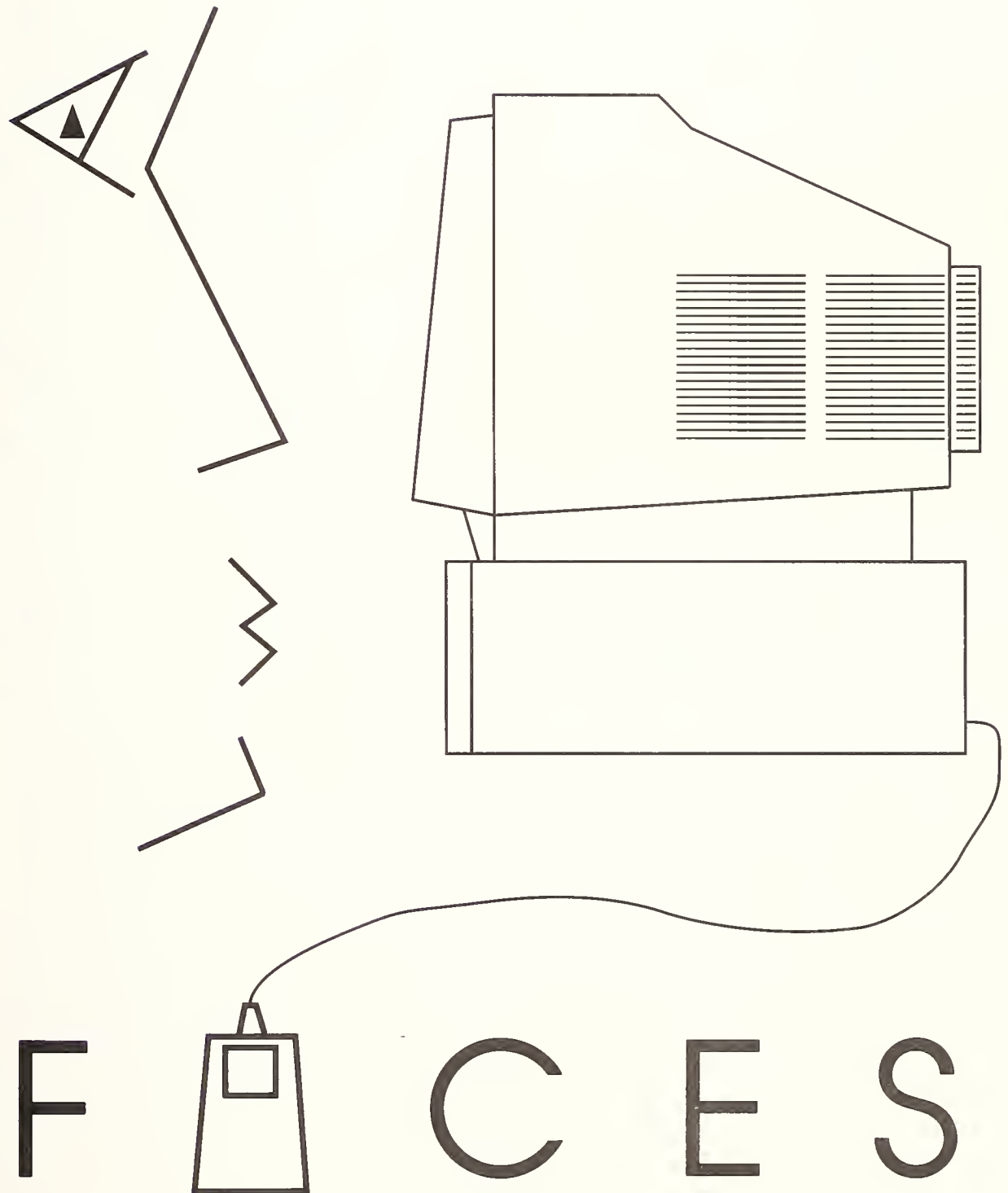


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The Computer as a Tool

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Everyone at some time has pulled a door instead of pushing it and felt a little sheepish. But look at that same door and you will frequently see that others have the same problem with it. A well-designed door has visual clues which are used without being conscious of them. For example, a vertical plate on the side to be pushed, and nothing on the other. Or visible hinges or a support pillar on one side. Or a push bar, or pull latch. Poorly design a simple device like a door and people have problems using it.

Now consider the radio. To tune a station on older radios required multiple adjustments, including antenna, radio frequency, intermediate frequency, and sensitivity. Modern radios usually have one knob with which stations are selected, making a complex technology easy for anyone to use. A well-designed tool, be it a door or radio, can be used without consciously thinking about the technology that makes it work. When we use such tools, we think of the task we are trying to accomplish, such as finding an up-to-date traffic report, and not about the tool itself. The radio is a good example of how new technology is frequently initially difficult to use, but with time, improvements make control and use of the new tool easier.

One tool that many people feel should be made easier to use is the computer. Some computers, such as those built into kitchen ranges, automobiles, microwave ovens, CD players and even games, are designed so that we are not aware of the computer. But when people interact with

computers via terminals or personal computers, they frequently become very aware of the computer. Instead of focussing on the task, such as gathering thoughts for a research paper, people spend time focussing on the tool, for example, wondering which command is used to add a footnote. If the computer is to reach its potential to allow us to extend human limitations, human-computer interaction must change.

There are many researchers, including some at the University of Toronto, looking at this and related issues. The field of human-computer interaction is interdisciplinary, including psychology, philosophy, computer science, and engineering. The research includes looking at how humans process information and seeing what requirements we have of computers.

One of the key areas to examine is the computer's human interface. The human interface is the way the computer presents information to us and accepts information from us in return. Science fiction's computers, such as the famous HAL from the movie *2001*, have human-like conversations. Those of you who attended the recent Apple Research Partnership Program Symposium saw Fraser Shein controlling his Macintosh micro-computer by speaking to it. Although Fraser's computer can be programmed to understand single word commands, it is a far cry from a computer capable of natural language dialogue. There are other examples, such as systems that allow specialized

database retrieval using limited vocabularies, but such systems present very definite limits to the human. Natural language dialogue will require more advances in artificial intelligence, linguistics, and other fields. Even if we could talk with computers, it isn't clear that natural language is the best form of communication for all tasks. For example, sometimes it is easier to point at what you want than to describe it. Or, sometimes, a synthetic language, such as mathematical notation, is less ambiguous than natural language.

For interacting with a computer, most terminals and personal computers have a screen to present information to us and a keyboard for us to provide information to the computer. Some also use a pointing device such as a mouse. The mouse is a deck-of-cards-shaped unit that fits into the palm of the hand and is rolled across a desk, moving an onscreen cursor. Using this screen and keyboard, and sometimes the mouse, depending on the computer used, some combination of form completion, menu selection, command language, and direct manipulation become the commonly-used styles of communication.

In form completion, the computer arranges that various areas of the screen, called fields, are available for the human to type in information. This interaction style is most suitable when the type of data is structured. For example, there might be a form to fill in a name, date of birth, and address.

Menu selection gives the

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human a list of available options. In some systems, the list is presented alphabetically or numerically and an option is selected by typing the appropriate letter, number, or function key (i.e., F1, F2). In other systems, the computer user selects the desired option by pointing the cursor at it. The cursor is moved using keys on the keyboard or using a pointing device like a mouse.

Available menu options can be described using words or pictures, sometimes called icons. Choosing from a menu is frequently easier for novices, especially if the options are designed well. When the list of options is poorly designed or when there are too many options, a menu can increase confusion.

One complaint of menus is that they occupy precious screen space. One solution is to have the menu located off the screen. For example, the word-processing package, WordPerfect, lists the available options on a template which you can attach to your keyboard. Another solution is to have menus "pulled down" or "popped up" only when needed. For example, if you point at certain places on the Macintosh screen and push the mouse button, a menu of options is pulled down. Or, as in WordPerfect 5.1, a combination of keys displays the menu on the screen.

Another style of interaction is where commands are typed at the computer. For example, if you use an IBM PC, you might type "DIR" to view a list of your files. Only certain commands are valid. Conceptually, it is as if there is a menu, but the computer keeps it hidden from you. If you know and correctly type an

available command, it is as if you selected that option from the hidden menu. A command language generally calls for a lot more learning and remembering on the part of a user than a menu does. On the other hand, for some complex tasks, a frequent user of the system might be able to type commands faster than selecting items from a menu.

Direct manipulation is still another method of interaction. With this method, objects on the screen can be moved and manipulated as if they were real objects. By using a graphical screen, the computer can draw pictures which can be good representations of real objects. Using a pointing device like a mouse, the objects can then be selected and manipulated. For example, a Macintosh user points at an icon representing a document and drags it to another icon representing a garbage can. Humans don't give instructions to the computer, they just act. In a word processor, you grab and drag the left or right margin, instead of figuring out and typing in a number. People generally find it easier to learn direct manipulation. It is difficult to explain why to those who haven't tried it, but there is more satisfaction and fun using such a method.

The challenge in designing a direct manipulation system is in finding a way to represent tasks with objects. Not all tasks can be represented in this way. The illusion and metaphor represented by the objects must be complete. Direct manipulation encourages exploration, a very important element in learning to use a tool effectively. But if the exploration leads to discovery of inconsistencies or limitations, the

mental model that the metaphor provides may be shattered.

Some computer systems, like the IBM PC, UNIX, and IBM

VM/CMS, tend to rely more on the command-language style of computer interaction. The Apple Macintosh relies more on direct manipulation. It uses a higher-resolution graphics screen and makes extensive use of icons. In fact, it is the first commercially successful graphical user interface or GUI (pronounced "gooey"), as systems which emphasize such elements are called. Other graphical computer interfaces include NeXT's NeXTStep, Atari's GEM, and Amiga's Intuition. For IBM PCs or compatibles with an 80286, 386, or 486 processor, there is IBM and Microsoft's OS/2 Presentation Manager. For those running DOS, there are add-ons like Microsoft's Windows, Digital Research's GEM, and Tandy's DeskMate, which will turn your interface into a graphical user interface. For those running UNIX, there are add-ons such as OSF's Motif, UI's OpenLook, DEC's DECwindows, Hewlett-Packard and Microsoft's PM/X, IBM's AIXwindows, and others.

Many people who use a GUI feel that it is one of the answers to making the computer easier to learn and to use as a tool. In this issue of *ComputerNews* we have a number of articles on GUIs. The first article explores the Apple Macintosh, the GUI which still sets the standard and against which others are measured. Other articles focus on the major GUIs in the IBM PC and UNIX worlds. In a future *ComputerNews* we will have articles about the direction of GUIs.

The Macintosh Graphical User Interface

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In the early 1950s, Doug Engelbart wanted to know how he could make "the most difference." Thinking of ways in which mankind's problems could be solved more efficiently, he arrived at a vision of graphic images coming from large screens, similar to the radar-screen consoles he had serviced. He was influenced by the work of other researchers, including a paper written in 1945 by Vannevar Bush on "memex," a device in which a researcher would store all his books, records, and communications and which was to be mechanized so that it could be consulted and used to derive new information. Committing himself to "augmenting the human intellect," much of Engelbart's research, including work on how researchers can use computers to collaborate more effectively, is only now gaining public recognition.

When Engelbart started his research at the Stanford Research Institute in 1957, typewriters connected to a large computer were just beginning to be used as a way for humans to interact with a computer. Despite that, Engelbart correctly foresaw that the "graphics screen" would one day be an affordable alternative. His research team worked with mixed text and graphics on screens with detachable keyboards. Their early experiments concerned selecting objects on the screen. Discarding earlier devices, Engelbart invented the

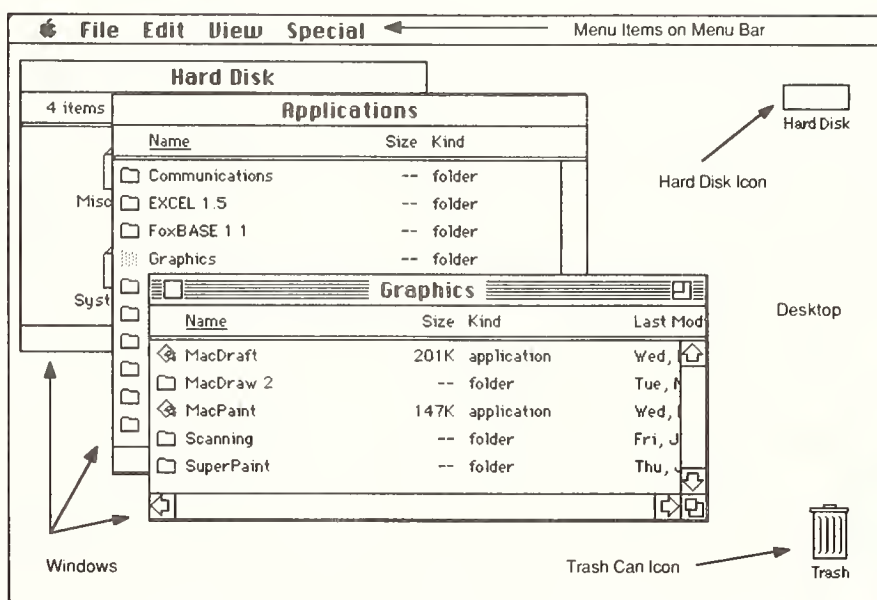


Figure 1: A look at the Macintosh desktop.

mouse and demonstrated that for this purpose it was faster and more accurate. In 1968, at a joint ACM/IEEE conference, Engelbart used a large projection screen to show his system with mixed text, graphics, and even superimposed video.

In 1970, Xerox established a research lab known as Xerox PARC (which stands for Palo Alto Research Center). PARC's unique research environment attracted some of Engelbart's colleagues, as well as many other researchers. Some brought their own visions, like Alan Kay whose Dynabook was conceived as a portable computer with the function of a book, paper, pencil, and keyboard. Together, these researchers developed the Alto computer (a number of which were built and used, mostly internally, by Xerox), and Smalltalk, an Object Oriented Programming System (OOPS) which is still gaining popularity today. The

Alto and its successors refined the ideas of using a black-on-white bitmapped display, an icon for a display cursor, and windows. Windows could be tiled or overlapped. To save space on the screen, a window could also be temporarily turned into an icon. The ideas of clicking objects to select them, double-clicking to open an object, scroll bars, and others were present. It was recognized early that a consistent user interface was essential so that, for example, a single "delete" command could be used with any selected object, whether it be a text string, a curve, or a file. In May of 1981, just three months before IBM brought out the first IBM PC, Xerox brought out the first commercial product based on their work, the Star. At \$50,000,

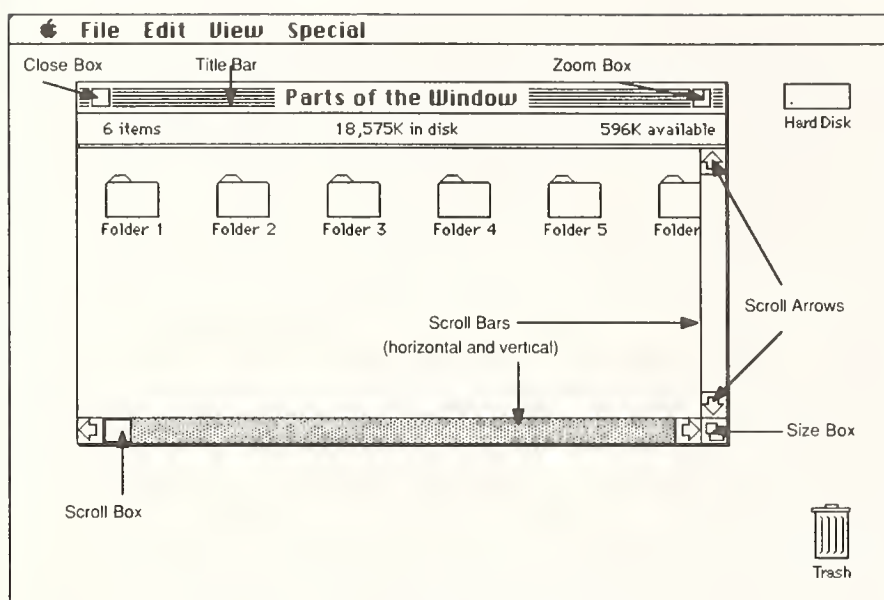


Figure 2: Parts of a Macintosh window.

it was expensive, and too far ahead of its time.

There were many visitors to Xerox PARC and the ideas developed there influenced products from many companies. One constant visitor was a Stanford Artificial Intelligence Lab researcher named Jef Raskin, who later joined Apple and convinced others at Apple in 1981 to visit Xerox. With further refinement of the ideas, the result was another unsuccessful product, the \$10,000 Apple Lisa. But a second product, the Apple Macintosh, released in 1984, has changed opinions of graphical user interfaces.

Figures 1 and 2 show a Macintosh screen with the familiar Apple Desktop where the human user keeps tools and documents. In Figure 3 we see a pull-down menu. Pull-down menus are standardized so that, for example, the "Quit" item is always in the same place. To use the menu elements, the mouse is used to select objects by pointing at them and clicking the single mouse button. By pointing at an object and holding the mouse button down, the object can be moved around the desktop.

The Macintosh tries to make it

comfortable to learn by exploring. Visual cues, in the form of the windows and pull-down menus, tell us where we are and where we can go. Critical actions, such as putting a document into the trash or changing a drawing, can be reversed. Analogies to previous experience are exploited by using metaphors such as the desktop. Pull-down menus are used instead of a command language, relying on human

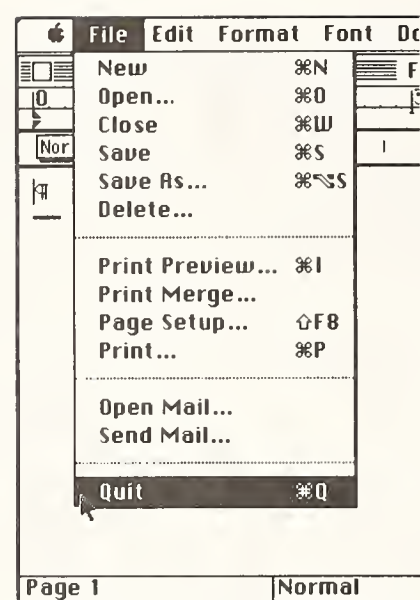


Figure 3: Quit command under the File menu is selected in Microsoft Word.

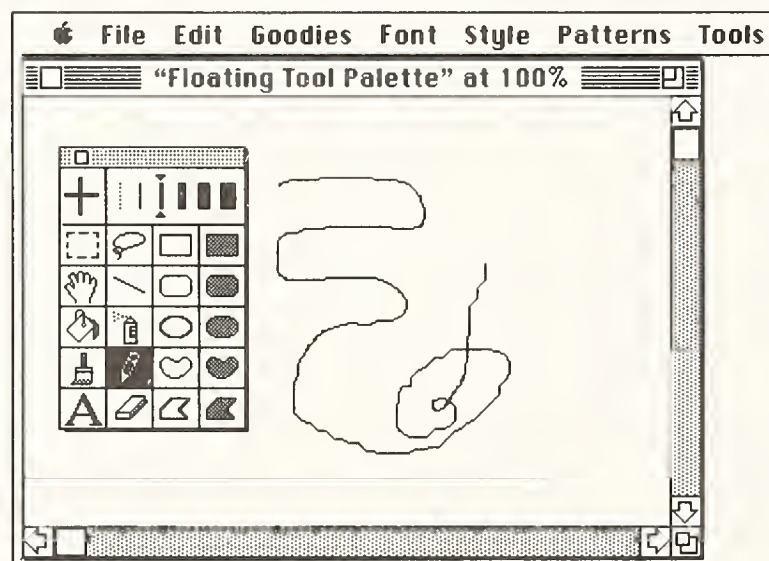


Figure 4: Floating tool palette in MacPaint.

recognition rather than recall.

By constantly checking for any input and immediately responding to it, the Macintosh puts the user in control. Modes are avoided as much as possible. (A mode is a state where actions have a different result.) Some modes are unavoidable; if you type a number while using a word processing application the meaning will probably be different than if you type it while using a spreadsheet.

In other cases, the Macintosh conceals the mode by providing a real world analogy. For example, in MacPaint, you can pick a pencil from a palette of tools (see *Figure 4*) and use it to draw. While you hold the pencil you are in pencil drawing mode. Alternatively, just as in the real world, you can easily switch modes by choosing spray paint instead.

One important part of the Macintosh design is a faithful screen representation of what will be printed. As much as possible, documents appear in the same fonts, spacing, and layout as they will when printed, eliminating most surprises. The look of the Macintosh screen is designed well graphically, with a simple, non-dazzling yet informative appearance.

To provide some interoperability between applications, there is a clipboard. Selected parts of one document can be copied to the clipboard and then pasted somewhere else in that document or into another document. A drawing done with the MacPaint application can be copied into a word-processing document. The clipboard metaphor has a limitation, however. Unlike a real clipboard, the Macintosh clipboard can only hold one item at a time.

But the most important part of the Macintosh is its consistency. An Apple marketing video points out that once we learn how to use a pencil we can transfer that skill to make it easier to learn to use chalk, highlighters, a paint brush, or a fountain pen. In the same way, once you learn how to use the first Macintosh application, you can transfer many skills to subsequent applications you learn. This consistency starts with a user interface that looks the same across applications. Applications don't draw their own windows, scroll bars, icons, or menus, for example. Instead, they call the standard Apple-provided toolbox routines to put

up these interface elements. Since it is the same program code that draws and watches the scroll bar in each case, it always looks and operates the same.

But consistency goes beyond just the appearance of applications. Menus in all Macintosh applications have important options in the same place on the same pull-down menu. Keyboard short cuts for selecting these options are the same. Methods of performing certain similar actions are also the same, as much as possible. For example, selecting a tool from a palette of tools, as is done when selecting a pencil in MacPaint, is something that most paint, draw, and CAD applications use. The way in which one moves or selects cells in a spreadsheet is the same no matter which vendor's application you are using.

Apple very strongly encourages this consistency. For those building applications, there is a book, "Apple Human Interface Guidelines: The Apple Desktop Interface." For those working with HyperCard, there is "HyperCard Stack Design Guidelines." A number of videos from Apple are available, including "Interface, Building the Right Tools." Technical assistance with the user interface design is available. A usage dictionary which encourages consistency of vocabulary when talking about the Macintosh is available. There are user interface technical bulletins which clarify commonly-experienced design problems. In the end, it is not Apple, but Macintosh owners who enforce consistency. Applications which don't meet the Macintosh user interface guidelines have tended to sell poorly.

So what makes the Macintosh work? Drawing to the screen is done by QuickDraw. QuickDraw allows drawing of simple things like lines, circles, text, and icons. Bill Atkinson wrote the QuickDraw program, and because of his skill, it is extremely fast. Otherwise,

the sluggish 68000 processor, used in models from the first Macintosh to the more recent Macintosh Plus, could not draw objects fast enough to maintain the illusion of manipulatable objects.

The Macintosh window manager uses QuickDraw. It is the program in every Macintosh's toolbox that applications use to draw windows. Issues, such as hiding parts of windows obscured by a window in front, are taken care of, as is the issue of moving a window when it is dragged.

Before using any application, every Macintosh user sees the Finder. It is the program which displays the Desktop mentioned earlier. It is through the Finder that documents are maintained by doing things like putting them into the garbage, renaming, copying, or organizing them into folders. The Finder is also the method by which applications are started. When a document is opened, the Finder automatically starts the correct application for the selected document.

QuickDraw, the window manager, the Finder, and the Macintosh operating system are very closely integrated. In fact, key parts of the system are in the Macintosh ROM (Read Only Memory). This means that even the hardware is closely integrated and designed for the Macintosh GUI.

With so much attention to the user interface, it is no wonder that Macintosh owners tend to be very loyal to their machine. Of course, the interface is not perfect and there is room for improvement. (For example, applications could be better integrated.) But despite this and other criticisms, the Macintosh remains the standard against which other graphical user interfaces are judged. Through its success, the Macintosh has legitimized the computer interface vision of Doug Englebart, Alan Kay, and other researchers.

Graphical User Interfaces on the PC

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In 1981, Apple approached Microsoft to develop software for their, as then, unannounced machines. Although the deal to develop Chart, Plan, and File for Apple to label and possibly bundle with each machine eventually fell through, Microsoft applications were instrumental in the success of the Macintosh. Today, Microsoft is the biggest supplier of applications for the Macintosh.

But Microsoft is also an important player in the success of the IBM PC, having made a deal with IBM to be the supplier for PC-DOS, the command-language based operating system. In 1983, Microsoft made a commitment to bring a graphical user interface to the IBM PC world. The result, released in 1985, was Microsoft Windows. At the time, Microsoft claimed that Windows and a graphic application could be run on an 8088-based PC with 256 kilobytes (KB) of Random Access Memory (RAM) and two floppy drives, but those who tried that configuration quickly discovered it wasn't practical. Even with 640KB of RAM and a hard disk, Windows was slow, the interface looked clunky, and windows could only be tiled, not overlapped. Lack of application compatibility with DOS didn't help.

There are other reasons why Windows didn't immediately become the standard user interface for the IBM PC. The market place was confused by

other, different looking, windows. At the time, IBM promoted its own graphical windowing environment called Topview, until the package faded into obscurity. But most important of all, Microsoft Windows lacked applications. Few people bought Microsoft Windows, so few vendors wanted to develop applications for it, which in turn reinforced the lack of users. Microsoft could have introduced Excel, its powerful spreadsheet package designed for the graphical user interface of the Macintosh (which made a big difference in the business acceptance of the Mac), but an agreement with Apple delayed its introduction on the IBM PC platform for two years. There eventually were a few applications for Microsoft Windows, such as the PC version of PageMaker, but users of such packages tended to use Windows only when using that particular application.

Apple had threatened to sue Microsoft over Windows before it was ever released. There was an agreement reached, in 1985, that Apple would tolerate Windows as long as Microsoft acknowledged it was a derivative work of the visual display generated by the Macintosh. In March 1988, Apple, concerned over new elements introduced into Windows with release 2 (including overlapping windows, fatter screen borders, minimum/

maximum icons for sizing windows, and mnemonic keyboard selections in menus), sued Microsoft and Hewlett-Packard, claiming copyright infringement of 11 elements of the Macintosh "look and feel." (Hewlett-Packard had been involved in the development of Microsoft Windows, but more importantly Hewlett-Packard's NewWave product used Microsoft Windows.) Microsoft tried to settle the case, mindful of its role as the biggest provider of Macintosh software, but Hewlett-Packard filed a counter suit alleging Apple had copied from Xerox's Smalltalk and Star interfaces. Xerox sued Apple last December, but its case has fizzled because Xerox waited so many years. All these cases have yet to be finally resolved, but their effect on graphical user interfaces has already been felt. Windows is now much less Mac-like in appearance. In fact, in the UNIX and PC worlds there are many similarities emerging in GUIs, and differences with the Macintosh. For example, where on the Macintosh the size of a window is changed by dragging a box in the lower right corner, under Microsoft Windows, OS/2 Presentation Manager, and many UNIX GUIs you stretch a window by dragging any of its borders.

The other big influence for GUIs on the PC has been IBM. In 1987, IBM introduced its System Application Architecture (SAA), a blueprint for the overall structure

of applications. The plan includes distributed applications, distributed databases, portability of applications and, most important to this discussion, a consistent user interface. IBM calls it the Common User Access or CUA. The initial CUA specification was disappointing primarily because it tried to establish a consistent user interface across PCs, as well as dumb terminals with no graphics capability. In May 1989, IBM signalled the obvious when it broke CUA into "entry" and "graphical" parts. The graphical part defines the windows, an action bar (which is the SAA terminology for a menu bar), and other elements. An extension to the graphical CUA-89 is the "workplace." Bearing some similarities to the Macintosh Desktop, it defines an iconic representation of applications and documents used in IBM's Office Vision product. (For those of you who wonder, Office Vision uses a paper shredder instead of the Apple Macintosh copyright garbage can icon.)

IBM was obviously mindful of Apple's litigation when it designed the CUA. But there are other genuine differences, the biggest being that CUA doesn't depend

on using a mouse; it provides keyboard equivalents for everything. Nevertheless, most users will find using a mouse easier.

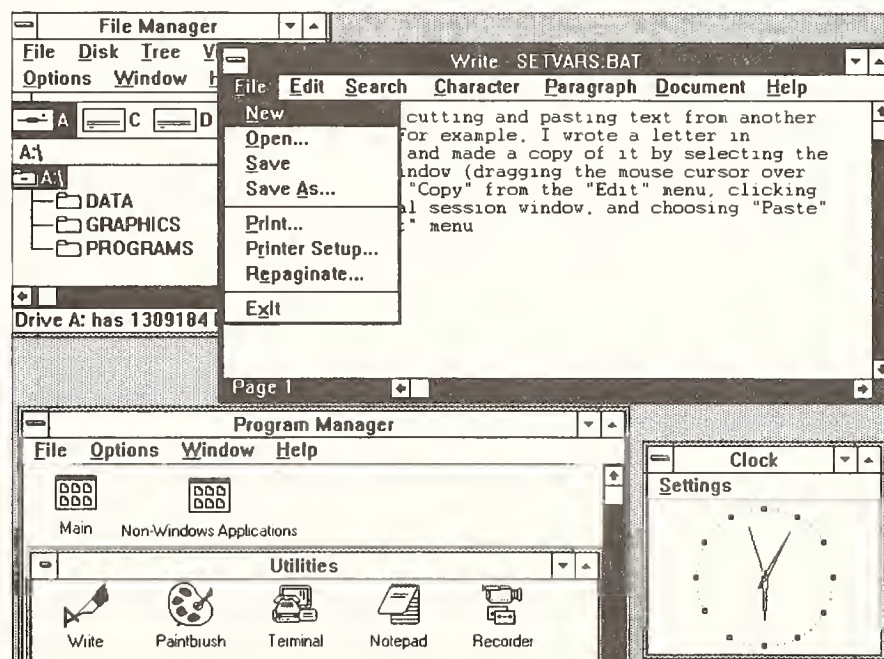
The first CUA-compliant operating system was OS/2. IBM and Microsoft jointly authored OS/2, an operating system released in December of 1987 which was to replace DOS on higher-end PC machines. OS/2 has many features like multitasking and relief of the 640KB memory limitation. With release 1.1, in October of 1988, came the Presentation Manager, the part of OS/2 that implements CUA. OS/2 has been slow to catch on, however. Among the reasons are that it runs DOS applications poorly, it requires more expensive higher-end machines, it is difficult to install, and there are few native OS/2 applications available. What native OS/2 applications are available don't seem to offer functionality which isn't already available with Microsoft Windows or with the Macintosh.

Despite saying that OS/2 was its strategic direction for the past few years, Microsoft has lately generated a lot of hype about a new version of Windows, released May 22, 1990. Windows 3.0 is CUA-compliant, with a

much improved user interface similar to that of OS/2. It has many features people thought they would have to switch to OS/2 to get, like multitasking and relief of the 640KB memory limit. The new version of Microsoft Windows has improved ability to run DOS applications and, in fact, does this better than OS/2. This is important in the transition, when a PC user wants to use new native Windows applications while retaining the ability to run older DOS applications. As for native Windows applications, Microsoft claims that there are over 700 applications currently shipping. (Native Windows applications will not run under OS/2 unless the developer rewrites the application for the latter, and vice versa, even though the two systems have very similar user interfaces.) Just as important, many hardware vendors of PCs have committed to including Microsoft Windows with their machines, often installing it on the hard disk at the factory.

Figure 1 shows a PC screen running Windows 3.0. In Windows terminology, the screen is called a desktop. Unlike the Macintosh Finder's desktop, you

Figure 1:
PC screen running
Windows 3.0.



cannot access files or start programs from the desktop. Instead, if you want to see what files you have, rename them, copy them, or move them, you have to use an included application known as the File Manager. You can also start applications from the File Manager by double clicking files. More commonly, applications are started from the Program Manager, a special application that automatically starts when Windows does.

Figure 1 also shows both the Program Manager and File Manager windows.

So what is the difference between OS/2 and Microsoft Windows? Microsoft Windows runs on top of DOS, whereas OS/2 completely replaces it as the operating system. IBM and Microsoft have signed an agreement that will limit the functionality put into Microsoft Windows. For example, the high performance file system, which allows file names longer than eight characters and performs better, will be limited to OS/2. IBM and Microsoft claim that if you have a 386 or 486 system with four megabytes or more of RAM, you should be running OS/2. Most people, however, suspect that the decision between OS/2 and Microsoft Windows will be made based on applications. Currently, there are very few applications that offer functionality under OS/2 that is not available under

Windows.

What about PC-DOS versus Microsoft Windows? Those of you with 8088-based computers should not consider running Windows. It will be too slow and many applications won't work. A minimum of an 80286 CPU is required, and a 386 is better. In many cases, you will need more than 640KB of memory. But we suspect that gradually some people in the University will switch. If you are a SAS user, the next release of SAS will require either OS/2 or Microsoft Windows to run. Other commonly-used applications will offer increased functionality only under Windows.

How does the Macintosh compare with Microsoft Windows? Most people who use both GUIs will agree that the Macintosh has a better and more consistent user interface. The underlying Macintosh operating system is also superior; for example, DOS users are limited to files with eight character names and three character extensions. This is not surprising. Windows must deal with a wider variety of hardware platforms and

screen types. Windows also must carry the baggage of DOS, whereas the Macintosh started clean.

It is useful to put GUIs for the PC into perspective. There are an estimated 40 million PCs worldwide, including thousands at U of T. It is estimated that there are fewer than 100,000 installed copies of the OS/2 Presentation Manager worldwide, and probably only a handful here. With the US\$10 million hype over the new Windows 3.0, Microsoft gave away 400,000 copies and has now sold about 200,000, although analysts estimate there will only be about 300,000 real users of the product by year end. At U of T, there are probably less than a hundred copies, although that number will likely grow. There are also other GUIs for the PC that have not been mentioned, but these are less significant. (One is Digital Research's GEM, whose primary use is with the application Xerox Ventura Publisher.) That means that most PCs worldwide and most of those at this university are not using a GUI environment.

With time, it is expected that more and more PC owners will switch to using a graphical user interface. Although we cannot be certain, it appears for now that Microsoft Windows will be the most widely used GUI, with OS/2 used for some high-end applications.

DOS Shells

Some of you with an IBM-PC or compatible microcomputer may be using a DOS shell like Disc Director, Magellan, Norton Commander, 1 Dir Plus, PC Tools Deluxe, Q-DOS, or Xtree DOS. If you are running DOS version 4 or later, you could also be using the built-in DOS shell.

A DOS shell is a program that can be used to replace the DOS command language. Most of the shells listed above can show file directories, search for files, copy files, rename files, and even view the contents of a file, usually by pushing keyboard function keys

or using a mouse. Some DOS shells also let you build a menu of applications from which you can select. For novice users, a DOS shell can be used to hide the cryptic DOS command language.

In some ways, the DOS shell is conceptually related to the Windows Program Manager and File Manager or to the Macintosh Finder. But the analogy does not go further. DOS shells are not GUIs. They do not provide windows for applications nor do they provide a consistent user interface among applications.

Graphical User Interfaces and UNIX

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Several UNIX graphical user interfaces are based on the MIT Project Athena's X Window system, a descendent of W Window, which was used to connect terminals across Stanford University in the early 1980s. First released in 1986, X Window is now at release 11 and, hence, often called X11. X is in the public domain and there are versions available for most vendors' UNIX machines. There are even versions for the Macintosh and MS-DOS machines.

X is not a complete GUI, but simply a protocol for applications to create windows and to capture keystrokes and mouse actions for those windows. What makes X Windows interesting is that an application doesn't have to be running on the same system as supports the display and keyboard. Instead, the application can be accessing the screen and keyboard through a computer network. For example, a UNIX user running X might have one window open running a program locally, another running an application on someone else's workstation, and perhaps another window running an application on a supercomputer.

In addition to using a personal computer or UNIX workstation, X can also be used with an X-terminal. Similar in concept to dumb terminals, X-terminals consist of a graphics screen, a keyboard, and a mouse. Unlike

personal computers or workstations, an X-terminal cannot run any application locally. Monochrome X-terminals typically cost from \$2000 to \$3000, while colour are more expensive.

The X window protocol does not define how the windows look or how they are handled. Instead, you have to get a program called a window manager. Depending on the window manager you use, your windows might be tiled or overlapped, the frame on your windows might differ, and the style of sizing or moving windows is affected. For example, if you use MacX, Apple's X windows for the Macintosh, your windows can look and handle just like Macintosh windows. The X distribution includes a sample window manager called uwm, but it is very rudimentary. There are other window managers, such as awm and twm, which have been used here at the University of Toronto.

Programmers who write applications for X put up user interface elements, such as menus or buttons, by using routines called widgets. Depending on the widgets used, the user interface inside windows is changed. There are several widget toolkits distributed with X, including the Xt toolkit developed by MIT and DEC, and the Andrew toolkit developed by MIT and Carnegie-Mellon University. There is also a number of com-

puter vendors with their own toolkits.

By using different widgets and window managers, completely different graphical looks can be accomplished. Hewlett-Packard has HP X Widgets, DEC has DECwindows using XUI widgets, Hewlett-Packard with Microsoft has an SAA/CUA-compliant Presentation Manager using the CXI widgets, etc. SUN, on the other hand, has NeWS (for Network-extensible Windowing System), which is not based on X. (NeWS, like X, is available for UNIX, as well as other operating systems.) Although all of these define different looks, not all are GUIs in the Macintosh sense. For example, some of these lack guidelines to make applications consistent. So the applications might have similar looking buttons or menus, but the placement and usage might vary from application to application.

In April 1988, AT&T and SUN Microsystems tried to establish a standard GUI for UNIX, by announcing Open Look. The designers looked at the Xerox Star, the Apple Macintosh, and OS/2 Presentation Manager. One of their design goals was to make it easy to switch between Open Look, Presentation Manager, and the Macintosh. As a result, most of the elements of the workspace, which is what the screen is called in Open Look, are familiar. There are some differences, however. For

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example, pull-down menus (called button stacks in Open Look), can be kept visible by putting a thumb tack through them, and the scroll bar looks like an elevator riding on a cable.

A more significant Open Look difference is the use of three buttons on a mouse. (The Macintosh always uses a one-button mouse. Microsoft Windows can use more than one button, but normally only one button of a multi-button mouse is used.) The first button is used to select and manipulate objects. The second is used to adjust a selection, such as increasing the amount of selected text. The third button is used to choose among pull-down menus. For those using Open Look with a mouse that doesn't have three buttons, a keyboard key is used to modify the meaning of the available mouse buttons.

To promote Open Look, a thick manual describing it and the

application consistency guidelines was made available. The specification is available without licensing fees. A toolkit of widgets, AT&T's XT+, to implement the elements of Open Look for X applications, is available. SUN has also made available the XView toolkit, based on its SunView toolkit, which permits Open Look to be implemented to X11/NeWS; this provides a migration path for Sun NeWS applications.

Other UNIX vendors, nervous that AT&T and SUN Microsystems would dominate the market place, created the Open Software Foundation (OSF). OSF, which includes vendors like IBM, Hewlett-Packard, and DEC, asked its member vendors to submit their ideas for a GUI. Interestingly, Apple did not submit the Macintosh GUI.

The result, called MOTIF, looks very much like the CUA interface used by Microsoft Windows and

OS/2 Presentation Manager on the PC. Like Open Look, MOTIF has a style guide and a widget toolkit. OSF/MOTIF has had an effect in bringing together its vendor members and they have all been tweaking their own GUIs so as to conform to MOTIF.

Right now, some people think MOTIF is winning over Open Look as the GUI standard for UNIX, but it really is too early to tell. There are also other confusing signals. For example, IBM's AIX UNIX system offers either the OSF/Motif or NeXT's NextStep GUI. And there may be dark horses waiting in the wings, such as Hewlett-Packard's NewWave, which is expected to be available for UNIX soon.

What about applications for X Window? The X distribution includes some sample applications including xterm (a terminal emulator), xcalc (a calculator), xmh (a mail handler), xclock (a clock), and a teX previewer. These and many applications available in the public domain are widely used at universities, including U of T. On the other hand, although there are many commercial application vendors who claim they will have applications for X Windows, there are still very few who do.

In conclusion, although windowing environments like X windows and NeWS have become popular among UNIX users at universities, there is no standard GUI for the UNIX environment yet. The situation is more confusing than even that for the PC, and no clear winner has emerged.

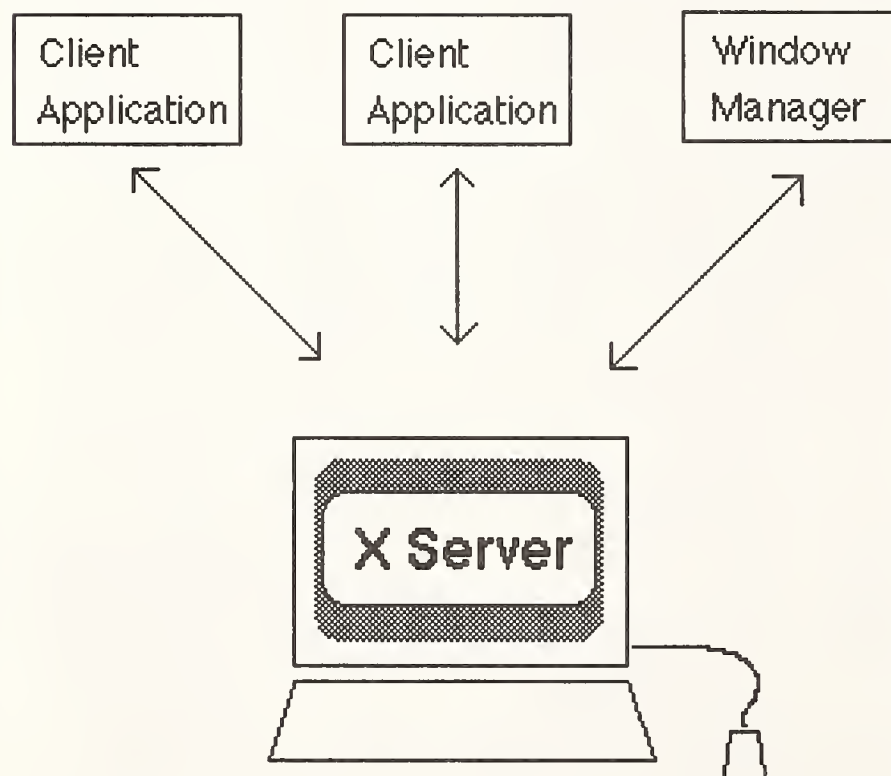


Figure illustrates X Server structure. The X Server controls the screen, the keyboard, and the mouse.

Magellan

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With all the talk about windows and mice in this issue, you might think that the only way to simplify working with your computer is to use a graphical user interface (GUI). **Magellan** is a program that proves the old adage "there's more than one way to skin a cat."

Rather than creating a seamless representation of some metaphor such as a "virtual desktop," Magellan offers a collection of extremely useful functions integrated in such a way that you need not know the details of operating system command language. The scope of these functions is so varied that sometimes it is difficult to define precisely what Magellan does. For the purpose of this review, I have divided Magellan's functions into three categories: Information Management, File Management, and Miscellaneous.

Information Management

Magellan offers a new approach to managing information on a hard disk. At the centre of this approach is the idea of making the contents of the various files on the disk immediately visible to the user. The selection of tools that Magellan uses to do this can be loosely grouped, as follows.

Viewers

"Viewers" display the contents of the files on the disk. A Viewer is a function that "understands" the special formatting instructions that a file contains, and can display the text and numerical information as if that

information were being displayed by the program that created it.

Magellan is also quite clever about figuring out which program created a file, so that the WORD Viewer is automatically selected for Microsoft Word files, and the dBASE Viewer is automatically selected for dBASE files.

File Selection Tools

When Magellan starts up, it presents you with a screen that is divided in two parts (see *Figure 1*). On the left side of the screen is a list of filenames. On the right side, the contents of the currently-highlighted file are displayed, interpreted by one of the Viewers. As you move the cursor through the list of files on the left, the contents of each file selected are displayed on the right. By pressing the right arrow key, you

enter the currently-highlighted file. Now all the arrow keys can be used to move through the file.

If Magellan decides that the file format you are using is plain ASCII (just text and no fancy control codes), you can edit the file right there and save the changes. This built-in text editor makes it very easy to change AUTOEXEC.BAT and CONFIG.SYS files, and is a tremendous improvement over the "edlin" editor of DOS.

The two modes of working with the file system control what you see in the left and right windows. VIEW mode shows you every file on the disk, one after the other, in the left window; the contents of the highlighted file are displayed in the right window. TREE mode provides a diagrammatic representation of the directory structure on the disk (see *Figure 2*). The left window can contain either directory names or

Lotus Magellan			Use F1 to select file, → to view							LIST	
Explore: All files											
AUTOEXEC.BAK			set conspec=c:\dos\command.com								
AUTOEXEC.BAT			path								
AUTOEXEC.OLD			c:\c:\telnet;c:\dos;c:\util;c:\wp50;c:\procomut;c:\dbase4:d								
AUTOEXEC.SAV			:C:\QPRO:C:\mag2								
AUTOEXEC.WIM			prompt \$p\$g								
BOOT.SYS			set procom=c:\procomut\								
CAFFILE.OUT			set configtel=c:\telnet\config.tel								
CONFIG.BAK			set temp=c:\windows								
CONFIG.OLD			c:\util\mouse.com								
CONFIG.SAV			ren c:\telnet\3c503 0x7e 0x3 0x300 1								
CONFIG.SYS											
CONFIG.WIM											
CPUSBU.BAT											
FAT.C											
FILECAB.BAT											
GPU.BAT											
HIMEM.SYS											
MAKEDISK.BAT											
OLD.C											
PH.BAT											
File 2 of 3927			C:\AUTOEXEC.BAT				Text		288 Bytes		
CTL	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	
Backup		Restore	UnDel	Zip	UnZip	Comp	Verify	Uur	MkDir	Demo	

Figure 1: Startup screen in Magellan.

Reviews

filenames (see *Figure 2*). If the highlighted name in the left window is a directory, the right window lists the contents of that directory, which can be either files or more directories. If the name in the left window is a file, the contents of the file are displayed just as they would be in VIEW mode. (I prefer to use the TREE mode.)

The Explore and Path functions are used to define sets of files that Magellan will work with. Sets of files can be defined according to their location in the directory structure, for instance, "all the files on the D: disk drive, or the files in the C:\PLANNING directory." Sets of files can also be defined according to type. Since Magellan can recognize files created by many programs, a set of files could be defined as "all the files on the C: drive created by WordPerfect 5.0".

Figure 2:
Example of TREE mode in Magellan.

Lotus Magellan		Use F1-F10 to navigate				TREE			
Tree: All Drives									
<A:\>	<DR3TOOLS>	<DIR>	7-05-89	2:22p					
<B:\>	<DRASE4>	<DIR>	5-05-89	12:13p					
<C:\>	<DOS>	<DIR>	3-13-89	1:44p					
<D:\>	<DYMATEX>	<DIR>	7-05-89	11:28a					
	<FOXPRO>	<DIR>	1-01-90	9:45p					
	<MAG2>	<DIR>	5-25-90	10:22a					
	<MOUSE>	<DIR>	5-05-89	2:07p					
	<PAZ86>	<DIR>	5-04-89	11:52a					
	<PFI X>	<DIR>	1-10-90	11:49p					
	<PLUS>	<DIR>	5-05-89	2:27p					
	<PROCOMUT>	<DIR>	5-05-89	2:31p					
	<QB>	<DIR>	1-05-90	5:28a					
	<QPRO>	<DIR>	10-31-89	12:34p					
	<RAM>	<DIR>	2-14-90	11:01a					
	<SITBACK>	<DIR>	1-16-90	1:40p					
	<STARLAN>	<DIR>	12-19-89	12:45a					
	<TELMET>	<DIR>	8-25-89	1:34p					
	<TEMP>	<DIR>	5-05-89	2:39p					
	<TEXTWARE>	<DIR>	1-05-90	5:25a					
	<UTIL>	<DIR>	10-12-89	1:40p					
Dir 3 of 4		C:*.*				219,165 Bytes			
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Help	Copy	Delete	Print	Gather	Sort	Launch	Zoom	Explore	Quit

Information Retrieval

In Magellan, there are two ways to search for information in files. The files on the disk can be searched directly or a special index of the contents of the disk can be searched.

You start the direct disk search while in either the VIEW or TREE mode by simply typing in the text string that you want to look at. Magellan then searches the files that are in the currently-defined index using the Explore function. This is very similar to the way programs like Gofer and PC-BROWSE work.

The index search, which Magellan calls a "fuzzy search," is operated from the Explore function and offers several advantages. During the search, Magellan compares a search criteria (a string of characters) to the set of files that have been indexed previously, to determine how similar the contents of each file are to the search string. Magellan then returns with a list of the files in which some elements of the search criteria were found. The list is ranked according to the closeness of the match between the file and the search criteria. This ability

gives the index search its fuzzy character. One index can contain up to 32,000 files, and multiple indexes can be created on a disk. Indexes also have a synonym list and a stop word or skipword list associated with them.

File Management

With a little bit of training and practice, most people can develop the skills required to use their favourite applications program, whether it is a word processor, spreadsheet, or database manager. The infamous MS-DOS prompt "C:\>" and the complexities of using the hierarchical file system intimidate many people. Unfortunately, sooner or later it becomes necessary to deal with the file system. This happens because we want to remove unwanted files, copy files to a floppy diskette for distribution or backup, or, more traumatically, retrieve files that we have accidentally erased. With Magellan, it is possible to avoid the MS-DOS prompt and still perform all the basic file management functions of copying, moving, renaming, and deleting files. You use the arrow

keys and space bar to indicate or mark files that you want to process, and the function keys to select the operation, e.g., copy, delete. When a function is selected, a message box that asks a few questions appears on the screen, and then the computer performs the operation.

Magellan also offers a quick unerase function which is very easy to use and quite effective—if you use it immediately. Unfortunately, if you create another file after the file was erased, the Magellan function probably will not work. These situations require a technically sophisticated package, such as Norton or Mace.

Backups

If Lao Tzu were alive today, he might have written something like this:

Back up your data.

Everybody knows this.

Nobody does it.

This is because backing up is time consuming and boring.

It is also difficult to use the MS-DOS backup utility.

Magellan's backup utility provides a flexible set of options for specifying the files that you want to back up. For example, you can use the menu choices to indicate that you want to back up only Excel spreadsheets that have not been backed up before. You can also define directory paths and file types for backup as a "Group." Backing up only the files that need it can help reduce the length of time and boredom associated with the job.

File Compression

Some people like to throw things out and other people like to collect things. The collectors of the MS-DOS world need a function like the Magellan ZIP. Magellan ZIP is an implementation of the industry standard PKZIP file-compression protocol. The ZIP function combines many MS-DOS files into one large archive and, in the process, squeezes out some of the wasted space. The result is that you have more room on your hard disk, while still keeping the information available.

Miscellaneous

Collecting Data

One useful feature of Magellan is its ability to combine information from different programs. For example, you might have an Excel spreadsheet file, a Lotus 1-2-3 file, and a WORD file, all of which you want to include in a report that you are writing in WordPerfect. The Magellan solution is to use the VIEW mode for each of the programs, capture the view of each file, and save it. The file format that the Viewer uses to save is a plain ASCII text file, without any troublesome format codes. You can import the ASCII text into your WordPerfect document and edit to your heart's content.

Launching Applications

You can start other programs with Magellan. When you do this, Magellan turns all but eight kilobytes (KB) of the memory over to the program that is being started. Magellan can also tell the launched program the name of the current file. Many programs will then load the current file immediately. When you have finished with the program Magellan reinstalls itself where it left off. In practice, you can move between your applications programs and Magellan without ever using the DOS prompt.

Macros

With a macro, a record of a series of keystrokes can be replayed by pressing a single key. Magellan can also execute a macro when it starts up. Macros can be used to automate many routine tasks in much the same way as do MS-DOS batch files.

Operation

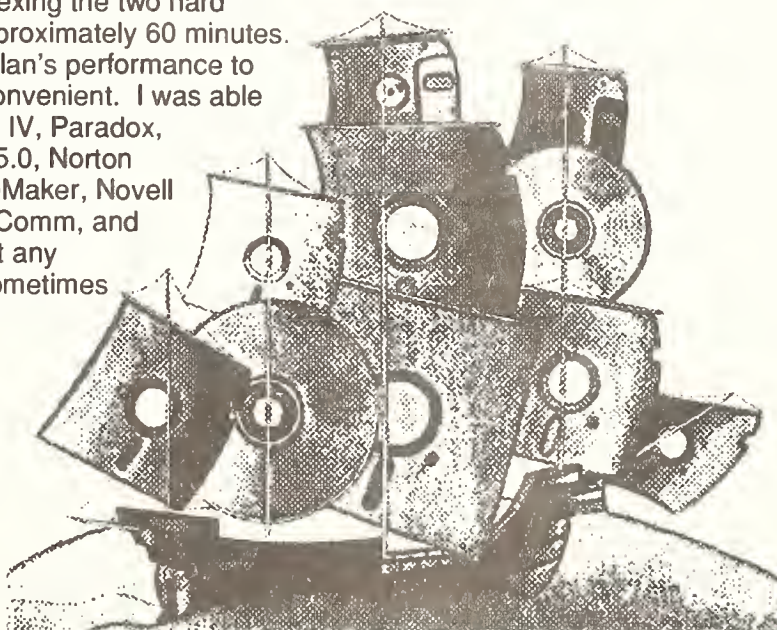
I installed Magellan on an eight megahertz (MHz) 80286 machine, with two 40 megabyte (MB) hard disks running PC-DOS 4.01. The installation process was simple and painless. Indexing the two hard disks took approximately 60 minutes. I found Magellan's performance to be fast and convenient. I was able to run dBASE IV, Paradox, WordPerfect 5.0, Norton Utilities, PageMaker, Novell Netware, ProComm, and Telnet without any problems. Sometimes

I found the DOS prompt to be the most direct way of doing things. Magellan quickly got out of the way and returned when I wanted it, just as quickly.

The documentation is thorough and readable. The main Reference Guide covers all the commands and functions in detail, providing examples and suggested uses. The reference also contains a section on installation, as well as a six-lesson tutorial that makes use of sample files included with the program. Two other books, *Quick Launch* (for those who hate manuals), and an *Idea Book* (using Magellan to help solve problems), round out the documentation.

Would You Find Magellan Helpful?

Many people will be well served by Magellan. Magellan's searching function and viewers benefit you if you use your computer to do a variety of tasks (such as word-processing, spreadsheet calculations, and database manipulation) and are working on diverse projects. The low memory requirements make it ideal on XT or laptop computers. If you are interested in more information about Magellan, call David Sutherland at 978-5426.



The Magellan logo.

Word-processing on the NeXT

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Using the NeXT

One way to evaluate your new computer is to use it for basic tasks. Whatever advanced features it may have, most of us use our computer for word-processing. For this reason, I decided to use the NeXT to write an academic paper using the bundled word processor, WriteNow. This is not an in-depth review of the whole environment; instead, I want to give you a feeling of what it is like to use the NeXT for a mundane task.

The first thing to notice about the NeXT is the screen. The size and quality of the display are ideal for text-related tasks. Word-processing, especially when writing academic papers, involves reading your work repeatedly. The NeXT monitor makes this task a pleasure. It is large enough to display a full page of text. In fact, if you have two documents open at once, you can see the text of both. Added to this is the ability of most text programs on the NeXT to zoom in or out on a document so that you can see the text enlarged or the page in miniature. This can be especially useful when composing documents where you want a thumbnail of the page to see how the text and white space are balanced (e.g., when writing a short letter where you want the text in the middle of the page).

When I first used the NeXT, I was overwhelmed by the proliferation of panels and windows. Because the NeXT allows you to run programs simultaneously, your screen can

become covered with the applications that are currently running. This became less and less of a problem as I learned to see only what I was working on and to hide those windows I was not using. In the future, I would like to see a feature that would hide everything but the active window with a single mouse-click.

As important as screen quality is the quality of the keyboard and mouse. Both are excellent; I especially like the response of the keyboard. In order to use the mouse on the NeXT, you have to become accustomed to the large screen. It is easy to lose your pointer, and difficult to move quickly between one place and another. On the NeXT, you can set the speed of the mouse so that experienced users can easily zip around the screen.

While the overall look and feel of the NeXT are superb, the bundled word-processor is only adequate. WriteNow on the NeXT closely resembles WriteNow on the Macintosh. There is an excellent automatic footnote feature, but it shares the Macintosh version's irritating lack of endnotes. To make matters worse, there is no easy way to extract the footnotes for placement at the end of the document. Trying to cut and paste them as a group causes WriteNow to crash, closing your files, and shutting down the application.

Otherwise, WriteNow has standard word-processing features. There is a spell-checker; it can open multiple

documents; and you can cut and paste from document to document. WriteNow shows you the page as it will print, including the white space at the top of each page, headers, graphics included in the document, and footnotes in place at the bottom of the page. Two glaring formatting omissions are the lack of both an underline feature and foreign accents.

The most annoying features when working with WriteNow on the NeXT are the appearance of the insertion point, and the text, on the page. If you press the Return key twice, the insertion point disappears for what seems an eternity. This may seem an unlikely thing to do unless, like me, you like separating paragraphs with a blank line (WriteNow offers no paragraph formatting options). The insertion point also has a way of sitting right on top of l's so that you do not know whether you have an "l" in the word "lose." If you have zoomed in on your text, which you more or less have to do to edit it, your insertion point will double in width for reasons unknown. The space between letters of onscreen text varies considerably. I had to continually check to see if I accidentally put a space between two letters because WriteNow was not placing the text accurately. This may be due to the PostScript screen driver, which makes a mockery of the claim that a PostScript screen driver is inherently better for publishing than other drivers. The advantage of PostScript was supposed to be the

accurate representation of what would be printed, which is not the case with WriteNow on the NeXT.

To deal with the above problem, I had to zoom in on the text until the display was adequate, which in turn created the insertion point problems. I should add that whatever problems I had viewing text did not appear on the printed versions.

One of the nicer features of the NeXT, from the perspective of word-processing, is the availability of cheap PostScript laser printing. Because PostScript is built into the NeXT, a 400 dots-per-inch laser printer, driven by the NeXT, is available at a very low cost.

The potential for integration of tools is what makes the NeXT an exciting environment to watch. Already the NeXT has accessories to word-processing that make typical textual tasks a pleasure. The first two are the online Webster's

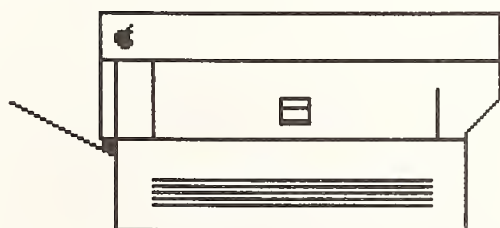
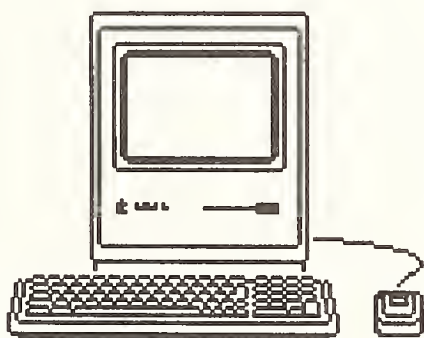
dictionary and thesaurus. Both can be called from within WriteNow. If you select a word such as "dialogue," you can request that this word be defined in the dictionary, searched for with the Digital Librarian, or looked up in the *Oxford Digital Quotations*. I found I used the dictionary a lot more than I used the other tools, or a paper dictionary for that matter. A few keystrokes away, I was tempted to look up words that I would not have bothered with elsewhere.

I did not use the trumpeted Digital Librarian as much as I expected because it is more for the user who has accumulated a large number of files. It is worth noting that the Librarian is not a text-analysis tool. It is not suited to finding all the instances of a word in a text, but rather for telling you if a document has at least one instance of the word. This is useful if you want to

know which letters mention "Rockwell", not if you want to check each instance of the word "love" in a single file.

Considering the cost and general quality of the NeXT, I think it is fair to have high expectations of its word-processing facilities. It seems that in the area of hardware (screen and keyboard), accessories, and printing the NeXT excels, but the word-processing basics are barely adequate. Unfortunately, there is no alternative to WriteNow unless you want to move to FrameMaker, a technical publishing program. This may not be fair to NeXT who have, after all, bundled WriteNow free of charge, but until there is a better word processor available on the NeXT, it will not be comparable to mature environments like the IBM PC or Macintosh.

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PC Users, Protect Yourself!

*Jon Alexander
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*Adam Iles
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"I just accidentally typed 'ERASE *.*' and deleted all the files in my DOS root directory! Can I get them back?" "Other people keep using my PC. Is there a way to prevent this?"

In response to questions like these, Advising Services evaluated three software packages that solve some of these problems. Known as "hard disk security software", these programs, or collections of programs, are designed primarily to protect your hard disk and all of the information it contains. These packages provide features that can be found elsewhere (e.g., software packages such as The Norton Utilities provide recovery and undelete-file functions), but in these packages they are nicely integrated and organized.

Certus

Certus is a PC security system with the widest collection of features of the packages we reviewed. It has an extensive manual, and covers most aspects of common PC security problems, including virus prevention, access limiting, and file recovery.

Prevention of Virus Infection

As most viruses attach themselves to executable files (programs), Certus creates encoded "signatures"

for all such files. These signatures are small files holding descriptive data about each executable file. Every time you try to execute a file, Certus checks that file's signature to determine whether it has changed. If it has changed, Certus will prevent the file from running and potentially infecting other files (assuming a virus has caused the signature to be changed). Updates to prevent new viruses, which are created as new viruses are discovered, are provided via a subscription service. A "Blue Disk" is sent in the mail to those Certus owners who have registered for the service. This service is not included in the purchase price.

Protection Against Access to Machine, Copying of Software, or Execution of Applications

By setting one or more passwords, Certus can limit software access to those persons who know the correct password. This can prevent unwanted persons from booting the PC from the floppy drive to bypass the security tool because each file can be given a password. Certus also keeps a log of all access attempts. The negative side of password protection is the amount of work you must do to protect all of your applications.

Helps Prevent Accidental Formatting of Disks and Erasure of Files

Certus keeps a record of file locations on your disk, extra information about the File Allocation Table (FAT, the "table of contents" on a PC hard disk) and other crucial areas of the hard disk. This information can be used to recover files that have been accidentally deleted. There was no indication if this would also help recover data from damaged files.

We found the package to be very comprehensive, and had only two hesitations: the complex installation process is time-consuming, and Certus is the most expensive package we examined.

Hardrive Overlord

Hardrive Overlord (HDO) is a security package consisting of several programs to control the access and use of your personal computer. The package provides protection ranging from password-protecting your computer to checking for programs issuing potentially destructive commands.

Hardrive Overlord comes as a copy-protected diskette in a cardboard sleeve. The sleeve includes instructions covering only the most basic

installation. The complete manual is provided in a 47 page text file on the diskette, which you will want to print in order to understand what Hardrive Overlord does to your computer.

You cannot protect your original HDO diskette with a write protect tab when you install this program because the copy-protection scheme writes information to this diskette during installation. (This ensures that you do not install HDO on more PCs than the license allows.) Unfortunately, this also means that if you already have a virus in your system, it may be transferred to your original diskette when you install the program.

Many of the package's features are provided through Terminate and Stay Resident (TSR) programs which monitor the computer as it is being used. As with all software-based security packages, the features provided by HDO can be defeated by a knowledgeable person. For example, HDO will not run if your computer is booted from a floppy diskette. This means that if you boot your system with an infected floppy diskette, your hard disk will likely become infected. Presently, most MS-DOS computers do not provide a mechanism to prevent booting of the system from a floppy diskette.

PCDATA

PCDATA is a data integrity toolkit provided free of charge by *PC Magazine*. This package will allow you to monitor any changes that have been made to your files and disks. Detailed installation instructions and user documentation are provided in the February 13, 1990 *PC Magazine* article which introduced this package.

It is strongly recommended that you put the PCDATA programs on a virus-free bootable floppy diskette (one that contains the DOS system files and can boot your machine), so that you can restart your system with the PCDATA diskette. The main advantage of booting your system from the PCDATA diskette is that you can be confident that your computer does not have a virus in its RAM. For the best protection, use a cold boot (i.e. turn the power off and on) since it is possible that your system may be infected by a virus which can stay in your system during a warm boot (booting without powering down, such as typing the <Ctrl> <Alt> <Del> key sequence from the keyboard).

On a floppy diskette, PCDATA maintains a record of your disk files and the initial information needed to boot the computer and find your files. When you insert the PCDATA diskette again, PCDATA will inform you of any changes to the programs on your PC's hard disk. Because the system keeps this information on a floppy diskette, it is safe from tampering by a virus, unless the diskette is inserted into a machine which was booted from an infected diskette or where an infected program was run.

Since PCDATA only notices differences in a file, you will not know about a virus infection until after it has occurred. The package can only recover data for which it has kept records. If you find that your system has been infected, you will have to remove the infected programs and restore them from the original diskettes or clean backups.

PCDATA should prove to be a valuable virus detection tool. By booting from a clean DOS diskette each time you use this package, you should be able to detect any virus which has infected your disk. The only limitation to keep in mind is that this package will not detect a trojan horse (an innocuous or useful-looking program with a malicious program inside it), or prevent one from damaging your system.

Certus, HDO, and PCDATA all differ in capability and cost. The least expensive solution, PCDATA, is also the simplest. For help in deciding which software package is for you, UTCS consultants are available to discuss your particular needs.

Certus

FoundationWare
13110 Shaker Square
Cleveland, Ohio
USA 44120
(216) 752-8188

Hardrive Overlord

A.B. Data Sales
2210 Hanselman Ave.
Saskatoon, Saskatchewan
S7L 6A4
(306) 652-7228

PCDATA

PC Magazine Library of Software
Utilities
Volume 8 Number 3, February 13,
1990, page 263
(Information about this utility may
be obtained by contacting the
UTCS Advising Office, at
978-HELP.)

Hot Links—Hot Stuff!

Ihor Prociuk
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Recent versions of several word-processing packages have introduced a feature called "linking." This feature allows you to establish a connection ("link") between a word-processor document and a spreadsheet, to copy data from the spreadsheet into the document, and to update the document with "fresh" data if the spreadsheet is changed. The entire task is done within the word processor. The only thing you have to know about the spreadsheet is where it resides in the computer (i.e., which directory, subdirectory, or folder) and which parts of the spreadsheet are to be included in the word-processor document.

Later in this article I will explain how to create "hot links" in WordPerfect 5.1, Microsoft Word 4.0 and 5.0 on the PC, and Microsoft Word 4.0 on the Macintosh. All of these word processors allow you to link to Lotus 1-2-3 and Excel spreadsheets. A complete list of supported spreadsheets is given in the word processor section.

The "hot" part of the link is mainly a marketing ploy. It gives the impression that while you are working with the spreadsheet, word-processor documents that contain linked data are updated automatically. This is not the case. All word processors with link capability require you to execute a series of commands to force an update after

the links have been established.

Users of Microsoft Word for both the PC and the Macintosh should not confuse spreadsheet links with document linking, which allows you to "chain" a series of documents together to form one long document.

When to Use Links

When I first looked into this feature, I thought that the only useful application would be in instances where regular (i.e., weekly or monthly) reports had to be produced from spreadsheet data. However, because the linking is so straightforward and the results are so impressive, I recommend using linking in any situation which requires spreadsheet data to be incorporated into a word-processor document. Here are some reasons:

- Keying errors are eliminated because information is copied directly from the spreadsheet.
- Last-minute changes are easily incorporated. Since documents often go through many revisions, linking makes updating (of the spreadsheet information, at least) almost trivial.
- On the PC, only the spreadsheet files are required. On the Macintosh, you need the spreadsheet application as well as the spreadsheet files.
- Conversion processes are eliminated. Without links, you would have to convert your spreadsheet data into an intermediate format (i.e., plain ASCII text or a "print" file) and then include it. If the spreadsheet changes, you would have to re-include each occurrence of the changed data, often losing any formatting that you had created.
- On the PC, no knowledge of spreadsheet operation is required. All you need to know is where the spreadsheets are located in your computer (i.e., the file, directory or subdirectory) and which portion of each spreadsheet is to be linked. On the Macintosh, you have to know how to select the portion of the spreadsheet you want to link.
- Any number of links can be established in a single document and links to different spreadsheets can be created. In WordPerfect 5.1 you can even set an option to have all links updated automatically whenever the document is opened!

Below I have created a typical situation to demonstrate links. Once you have digested the scenario, you can skip to the section covering your particular word processor to see how to actually perform the link.

The Scenario

Roger Thompson prepares a monthly report for the Chairman. The report, which he keeps in a document called "C:\MONTHLYREPORTS\3month.doc", covers, among other things, office expenditures: long distance calls, courier services, photocopy paper, and fax costs for the last three months. Jennifer Smith, the Administrative Assistant, keeps the data on the PC in a Lotus 1-2-3 spreadsheet called OFFICE.WK1. Once a month, she gives Roger a copy on a floppy diskette. Roger then copies the spreadsheet file into his C:\MONTHLYREPORTS subdirectory. (If Roger and Jennifer work with Macintoshes, then Jennifer's spreadsheet might be in an Excel file called OFFICE and could end up in Roger's machine in a folder called REPORTS, which is within another folder called MONTHLY.)

Figure 1 shows part of the OFFICE spreadsheet. For convenience, Jennifer has "named" some of the areas (or "ranges" in the jargon of spreadsheets). In fact, it is recommended that you name each range you intend to link. While linking will work without named ranges, only named ranges will be correctly updated if the data in the spreadsheet is moved or resized.

	A	B	C	D	E
1					
2					
3					
4	Service	April	May	June	
5	Courier	157.94	78.04	85.32	
6	Fax	226.68	195.34	240.12	
7	Long Distance calls	545.89	497.76	534.94	
8	Photocopy Paper	489.77	276.90	264.40	
9	Total	1,420.28	1,048.04	1,124.78	
10					
11	Service	January	February	March	April
12	Courier	127.95	59.31	96.57	157.94
13	Fax	159.56	189.26	201.04	226.68
14	Long Distance calls	497.01	602.33	587.07	545.89
15	Photocopy Paper	396.77	301.85	469.02	489.77
16	Total	1,181.29	1,152.75	1,353.70	1,420.28
17					

Figure 1: Part of the OFFICE.WK1 spreadsheet. The range A4..D9 has the name "lastthree."

Linking in WordPerfect 5.1

WordPerfect 5.1 will allow you to link data from PlanPerfect (versions 3-5), Lotus 1-2-3 (versions 1-2.2), and Excel (all releases of version 2). (PlanPerfect is a spreadsheet package from WordPerfect.) Follow these steps:

1. Start WordPerfect and load the document that is to contain the linked data: C:\MONTHLY\REPORTS\3month.doc. Position the cursor at the location in the document where you want the first portion of the spreadsheet to appear.
2. Execute the Text In/Out <Ctrl> <F5> command and choose the Spreadsheet option.
3. Choose the Create Link option and supply the following information:

Filename	The full path name of the spreadsheet. In our case, it would be C:\MONTHLY\REPORTS\office.wk1.
Range	The range of cells that you want to include. You can enter the range in various formats: • Enter the range name by simply typing it in (e.g., lastthree as in Figure 1). You can get a list of named ranges with WordPerfect's List command <F5>. Highlight the range that you want and press <Enter>. Wherever possible, used the named range technique. • Enter the upper left and lower right cell addresses of the area you want to include in any of the following formats: A4;D9 or A4.D9 or A4..D9
Type	The option you select here tells WordPerfect to copy the data from the spreadsheet into either a Table format or text format. The Table format makes it easy to enhance the information with attractive borders. Figure 2 shows linked data in Table format.
Perform Link	This causes the linking and copying of data to take place.

The results are shown in *Figure 2*. The rectangular boxes surrounding the linked data are only informational; they do not appear when the document is printed.

To edit a link, position the cursor immediately following the End Link code (use Reveal Codes) and then select Text In/Out, Spreadsheet, and Edit Link. Make any necessary changes to the filename, range, or type and then execute Perform Link again.

To "break" the link between document and spreadsheet, delete the Link or End Link codes (use Reveal Codes). This removes the link but not the data. Use standard editing techniques if you also want to delete the data.

Other options include Show Links, Update All Links, and Update on Retrieve. These can be found by executing the Text In/Out, Spreadsheet, and Link Options commands.

(For more general information, see "Other Points to Consider," below.)

Below is a report of office expenditures for the last three months

Link: C:\MONTHLY\REPORTS\OFFICE.WK1 LASTTHREE

Service	April	May	June
Courier	157.94	78.04	85.32
Fax	226.68	195.34	240.12
Long Distance calls	545.89	497.76	534.94
Photocopy Paper	489.77	276.90	264.40
Total	1,420.28	1,048.04	1,124.78

Link End

D:\WP51\3MONTH.DOC

Doc 1 Pg 1 Ln 1.19" Pos 1"

Figure 2: WordPerfect screen just after the link has finished.

Linking with Microsoft Word 4.0 and 5.0 on the PC

From a Word document on the PC you can link to the following spreadsheet products: MultiPlan, Excel for Windows, and Lotus 1-2-3. Follow these steps:

1. Open the Word document and position the cursor at the place in the document where you want the linked data to appear.
2. Choose the Library Link command in Word 4.0 or the Library Link Spreadsheet command in Word 5.0. Supply the full path name of the document (in our scenario it is C:\MONTHLY\REPORTS\office.wk1) and the area or range of the spreadsheet you want to link to. You can reference this range in several ways:
 - If the range has a name, enter the range name (e.g., lastthree). By pressing <F1> at this point, you can get a list of named ranges in the spreadsheet.
 - If you are using MultiPlan, you can specify the range by giving the addresses of the upper left and lower right cells (e.g., R4C1:R9C4, see *Figure 1*)
 - With Excel or Lotus, you can specify the range using column letters and row numbers (e.g., A4..D9, see *Figure 1*. Note that for Excel, this is not the "usual" range notation.)
3. Press <Enter> to perform the link.

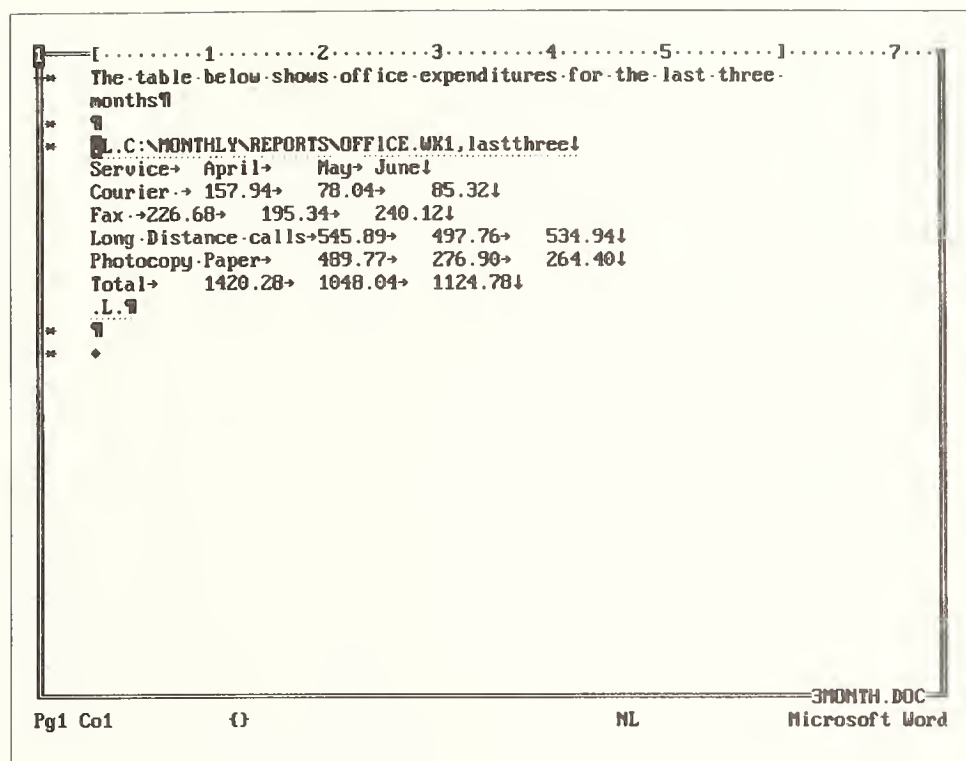


Figure 3: Part of the Word document after the Paste Link command.

The linked data is also preceded by hidden text of the form: ".L.spreadsheet location and name,range" and ends with the hidden text ".L. ". The hidden text does not appear when the document is printed. If the hidden text is not visible, set the Show Hidden Text field on the Options command to Yes.

To update all linked data in a document, first select the entire document with <Shift> <F10>. To update only one linked area, select the table and the preceding and following hidden text. Issue the Library Link command in Word 4.0 or the Library Link Spreadsheet command in Word 5.0, but leave the filename and range fields blank. Press <Enter>. Word will stop at each linked area and ask you if you want that particular range updated. (For more general information, see "Other Points to Consider," below.)

Figure 3 shows the Word screen just after the link has been completed. The linked data is inserted into the Word document; each column is separated by tabs with a newline character at the end of each

row. Thus, the entire table is one paragraph. You will have to adjust the tab positions to realign the material. Any new format you set will be maintained in subsequent updates.

Linking with Microsoft Word 4.0 on the Macintosh

Word 4.0 can link data from Excel spreadsheets (versions higher than 1.03). Macintosh users require that MultiFinder be active. MultiFinder will run on a Mac Plus, SE, or Mac II, and requires System version 5.0 or 6.0. In addition, your Macintosh should have at least two megabytes of memory; otherwise, there will not be enough memory to run both the word processor and the spreadsheet program at the same time. Follow these steps:

1. Make certain that MultiFinder is active. (You do this using the **Set Startup** under the **Special** menu.)
2. Open the Word document and position the cursor at the location in the file where you want the spreadsheet data to appear.
3. Use MultiFinder to open the Excel spreadsheet you want to link to. While in the spreadsheet, select the area (i.e., range) that is to appear in the word-processor document and choose Copy from the Edit menu.
4. Use MultiFinder to switch back to the Word document. Select Paste Link from the Edit menu. Figure 4 (next page) shows the Macintosh screen just after the completion of the Paste Link command.

The table below shows office expenditures over the past three months.

Service	April	May	June
Courier	157.94	78.04	85.32
Fax	226.68	195.34	240.12
Long Distance calls	545.89	497.76	534.94
Photocopy Paper	489.77	276.90	264.40
Total	1,420.28	1,048.04	1,124.78

Figure 4: Part of the Macintosh screen after the Paste Link command.

When the spreadsheet material is linked into the word-processor document it appears in "table" format if you are using version 2.2 of Excel. Earlier versions of Excel will present the spreadsheet in tab-delimited format. Use Show ¶ from the Edit menu to reveal the format. The linked data is preceded by a line of the form which reads "Application!document location and name!range". This line is formatted as hidden text and will not appear when printed. If you don't see this line, select Show Hidden Text under the Preferences command in the Edit menu. If you still don't see this line, you probably used the Paste command instead of Paste Link. Try again.

The linked range in Figure 4 previously had been named "lastthree". If it had not been named, it would have appeared as R4C1:R9C4 (i.e., all data in the rectangle with the upper left corner cell in Row 4—Column 1 to the lower right corner cell in Row 9—Column 4. See Figure 1).

Contrary to what the manual says, you cannot update a subset (i.e., single column, single cell, etc.) of the linked data table. It's all or nothing. Choose the Update Link command from the Edit menu. Each linked area must be updated individually; there is no global update option.

To edit linked data in the spreadsheet and then have the changes updated in the word processor, position the pointer anywhere inside the linked table in the word-processor document and hold down the Shift key while you select Edit Link from the Edit menu. You will be placed in the Excel spreadsheet. Make any necessary changes. To return to the word processor, press the <Command> <, > (comma) keys. If you exit with the MultiFinder, no update will occur.

If you want to edit the table you should use table editing techniques such as the Table Ruler on the Ruler Bar. If you don't want the linked data to appear in table format: (1) delete the linked material but not the hidden text that precedes it, (2) select the hidden text and a following blank line, (3) perform Update Link again. (For more general information, see "Other Points to Consider," below.)

Other Points to Consider

- Do not place one linked area inside another. Subsequent updates will be incorrect.
 - Each linked area starts a new paragraph—you cannot have linked data in the middle of a text line.
 - Each package covered in this article has limitations on the amount of data that can be linked in a single link area. Check the reference manual if you feel you will be linking an unusually large portion of a spreadsheet.
 - Because the link contains a reference to the spreadsheet, changes to the spreadsheet's name or location will mean that you will also have to change these references in the word-processor document.
 - Whenever possible, you should use named ranges to indicate the area of the spreadsheet you want to link to. If this area is redefined (i.e., moved or resized) in the spreadsheet, it will still be correctly updated in the word-processor document. If you are not responsible for the spreadsheet data, bring these matters to the attention of the person who is.
- For more information about linking, call Ihor Prociuk at 978-6875.

COREL DRAW 1.2 Upgrade

Terry Jones
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COREL Systems has recently released version 1.2 of COREL DRAW, a high-quality illustration program for MS-DOS computers. Version 1.2 of has a number of new features, including compatibility with Windows 3.0, a new tracing utility, and improved import/export capabilities.

COREL DRAW 1.2 is compatible with Windows 3.0. You won't see annoying compatibility messages every time you start COREL DRAW or use the import/export commands! Although the previous version of the program will run despite the warning, it might not run as reliably under Windows 3.0 as the upgraded version does.

Version 1.2 contains CORELTRACE, a bitmap tracing utility that allows you to convert

scanned images to COREL DRAW artwork more easily.

COREL has also improved COREL DRAW's import/export capabilities, including AutoCAD DXF import and export. This allows you to scan images, use CORELTRACE to change them from bitmap images into COREL DRAW vector drawings, and then export them as AutoCAD DXF files that you can use in your CAD applications.

The old COREL DRAW, version 1.1, can import Adobe Illustrator files, but version 1.2 can import *and* export Illustrator files. This should make sharing graphics in mixed

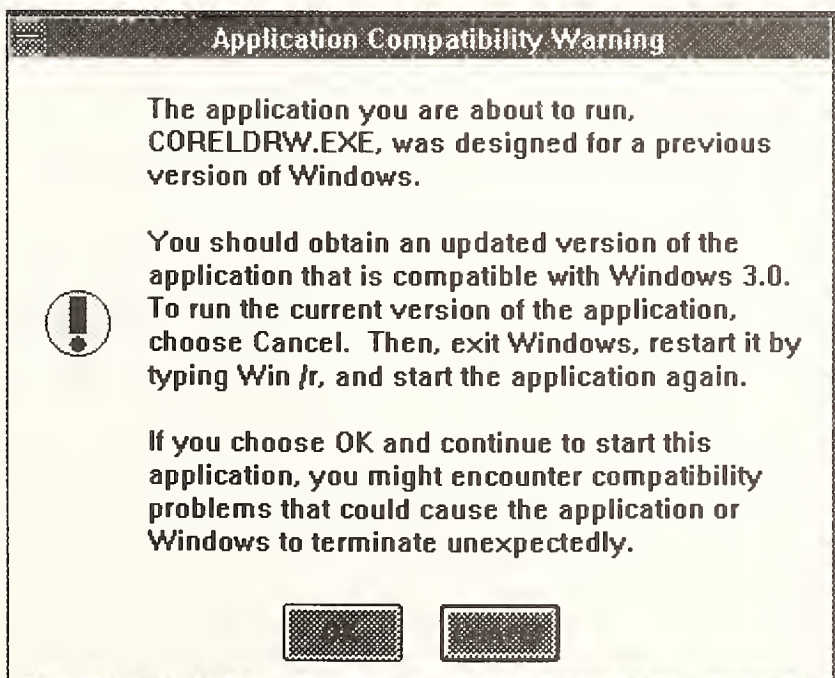


Macintosh/MS-DOS environments a little easier.

Upgrades to COREL DRAW normally cost \$125, but COREL

Systems gives the University a 30% discount, bringing the figure to \$87.50. Your present copy of COREL DRAW has to be registered in order for you to upgrade. (COREL has all the registration information online to help track down your registration.) Those of you who took advantage of COREL's special software giveaway should register your software if you have not yet done so, and then should follow standard upgrade procedures.

Contact COREL Systems at (613) 728-8200 to upgrade your software. If you need more information about COREL DRAW, contact Terry Jones at 978-4924.



Screen capture of COREL DRAW warning.

X.500 Directory Services

Glenn Britton
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Have you ever tried to determine the electronic mail address of a colleague or friend at another university within Ontario? How about someone overseas? More often than not, you would be required to write or telephone either the electronic mail administrator at the institution or the person. If this sounds like a terribly inefficient way to find an electronic mail address, it is. Could you imagine writing away for a correct telephone number as opposed to dialing 411? To date there have been no national or international "white pages" for electronic mail users. There are approximately eight million people using electronic mail in North America alone, and the number of users is growing rapidly worldwide. There is a definite need for a directory of electronic mail users and X.500 is attempting to satisfy that need. X.500 directory services will provide people with information on how to establish communication with other people.

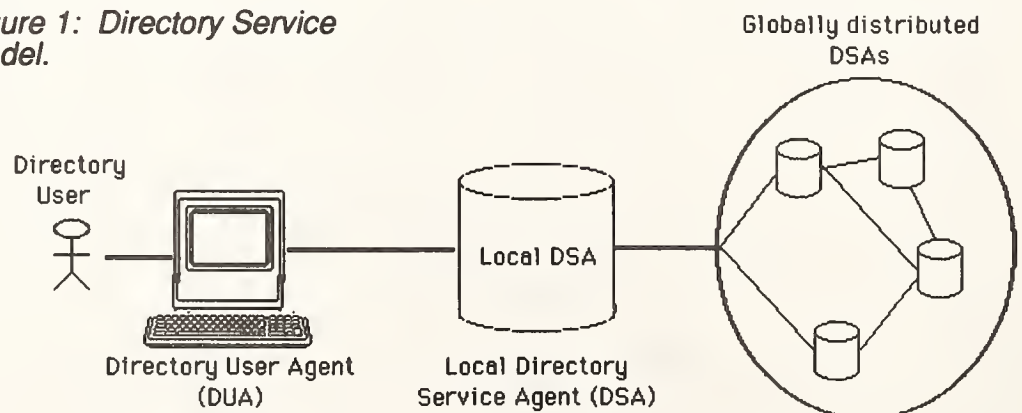
X.500 is a new international standard for computer communication emerging from the work of the United Nations' *Comité Consultatif Internationale de Télégraphique et Téléphonique* (CCITT) and the International Standards Organization (ISO). The aim of X.500 is to specify a standard to interconnect distributed directory services to provide a global directory of people, organizations, and

computer resources. X.500 runs over OSI networks, although there now exists a way to run OSI protocols over TCP/IP networks (which are more common in North American universities). Any organization in the world connected to the TCP/IP Internet that is also running an X.500 service can be a part of the global directory.

A single, centralized global directory service would have severe problems. First of all, huge computing resources would be required to operate such a service. Also, a centralized service would be highly vulnerable. Administration of a centralized global directory would be next to impossible, analogous to the problems of compiling a single telephone directory for the approximately 500 million telephones in the world. Just as telephone directories are distributed among countries, provinces and states, and further among counties and cities, a directory service for electronic mail users would also need to be highly distributed in order to be practical and up to date.

With the X.500 standard, a distributed global directory would be formed by the collective efforts of Directory System Agents (DSA), programs that communicate with each other across the Internet (see *Figure 1*). Each organization in the directory would run a DSA to provide local directory service. Other DSA programs would run at the national level to provide directory service between countries, and one DSA would operate at the supra-national level, holding information about all the national level DSAs (see *Figure 2*). The communication between DSAs is what provides the global service. A typical address enquiry would have someone type the name of the intended recipient using the directory's user interface (see *Figure 1*), a program called the Directory User Agent (DUA). The DUA will try contacting the local DSA to determine the existence of the person's name in the local X.500 directory. If the recipient is not found on the local network, the local DSA will send the query to a remote DSA "closer" to the recipient's address, and send

Figure 1: Directory Service Model.



the address information back to the querying user. If I were to look up the address of someone at the University of Stockholm, the local DSA would pass my request to the national DSA for Sweden, which would forward my request to the DSA at the University of Stockholm. This DSA would send me a reply containing the address if it was found. This query is analogous to dialing local telephone directory assistance and requesting the number for a person in another country.

What's in a Name?

The conventional postal system has the requirement that each person have a unique address consisting of country, province or state, city or town, street address, and their name. In a similar way, every individual in the X.500 directory is identified uniquely by their Distinguished Name. *Figure 2* illustrates the naming hierarchy of the directory. An X.500 Distinguished Name is formed by concatenating names from the country level to the level representing people. For example, my Distinguished name would be: country=Canada, organization=University of Toronto, department=Computing Services, and name=Glenn Britton. Entries for people and other objects may occur at any level, as *Figure 2* illustrates.

Certain conventions are used to ensure that names are well-known and descriptive, enabling easy queries. Abbreviations are avoided in order to reduce confusion. For example, if someone were to query Canada for a list of organizations, U of T would not be as clear as University of Toronto.

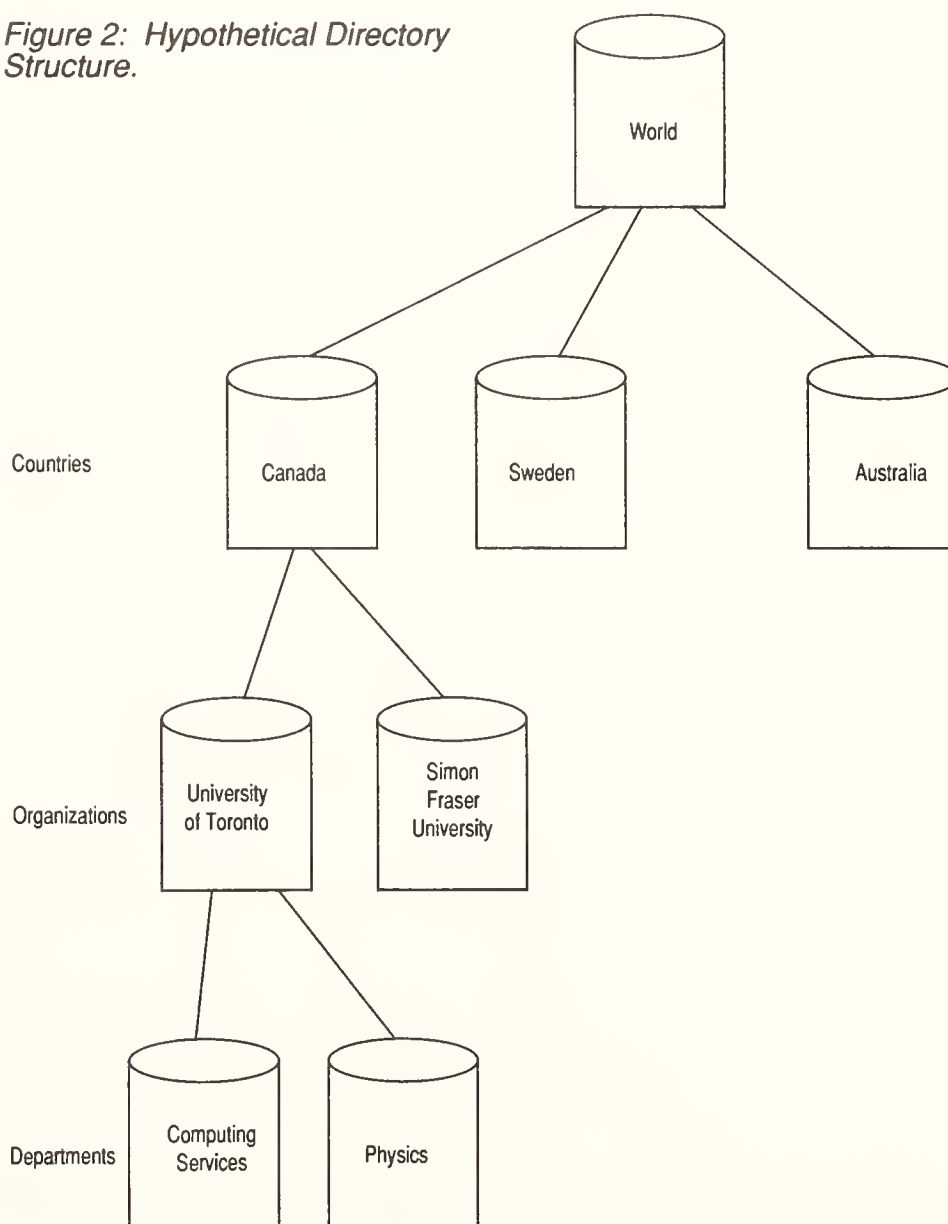
The directory services provided by X.500 have the potential to be much more sophisticated than services provided by the telephone directory, since X.500 directory entries may have many more attributes than name, address, and telephone number. Personal attributes of X.500 directory entries can include

such things as research specialization and digitized photographs. The X.500 directory is sometimes referred to as the "rainbow pages" rather than the white pages because of this rich set of possible attributes. The following type of query would be possible by combining various directory attributes: "List the names of all people at Simon Fraser University's Department of Chemistry who conduct polymer research". Personal directory attributes are not standardized under X.500 as of yet, and their inclusion in the directory is controlled by the individual.

The X.500 protocol is an evolving

standard, and important issues concerning directory security are being resolved by the CCITT and ISO. Access controls are needed to resolve the dilemma about what information about persons in an organization is restricted, and what is freely available. Some organizations may not want entire lists of departments to be generated from a query to their local directory. Someone querying the directory may have to provide at least a name, organization, and country in order for the query to be valid. Directory security recommendations are expected for the 1992 CCITT/ISO standard.

Figure 2: Hypothetical Directory Structure.



The Pilot Project

In July 1989, Nysernet Inc., a non-profit network services and software organization based in Troy, New York, sponsored an X.500 directory pilot project together with several New York universities connected to the TCP/IP Internet. The software used for the project was developed by the Computer Science department at University College London, England. The software is named Quipu, and it runs on computers

supporting Berkeley UNIX. As of June 1990, the pilot X.500 directory included entries for over 200,000 people from approximately 300 universities and other organizations located in 15 countries. Some of the participating organizations, such as Columbia University, have integrated information from their personnel departments into their local X.500 directory. Columbia University has 14,000 entries spanning most departments in its X.500 directory.

Here at the University of Toronto, UTCS is the only department currently participating in the directory project, with approximately 80 entries. UTCS is responsible for managing the Canadian portion of the pilot directory.

For a demonstration of the Quipu X.500 software or more information on departmental participation in the X.500 pilot project here at the University of Toronto, please contact Glenn Britton at 978-6346.

VM/CMS Upgrade

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During the summer, UTCS will be upgrading the VM/CMS operating system to release 6.0 from the current release 5.0. There are some changes in the new release, and in order that your local EXECs continue to work, you should be aware of these changes.

1. There is one new CP command: GIVE

2. There are new CMS commands:

ALIALIST	AUDIT	AUTHLIST	BACKUP
CREATE	CSLGEN	CSLLIST	DIRLIST
DISABLE	ENROLL	ETRACE	FILEPOOL
FILESERV	FORCE	GRANT	LISTDIR
MODIFY	NETDATA P	ROGMAP	RELOCATE
REVOKE	RTNDRO	PRTNLOAD	RTNMAP
RTNSTATE	SEGGEN	SEGMENT	SETKEY
STOP			

3. REXX has been upgraded; programs should be upward compatible.

4. The text of some messages may have changed and some return codes have changed also. Any EXECs relying on the exact text of a message or relying on a specific return code may be affected.

If you should have any further questions you should contact the UTCS Advising Office at 978-HELP or send mail to advisor@utcs.

Introduction of UTCS V.32 Dial-in Facilities

Doug Carson
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On May 28, 1990 UTCS expanded its modem facilities through the introduction of a new V.32 dial-in service. This new service provides access for individuals with modems capable of supporting the V.32 modem communication standard [9600 bits per second (bps) over regular voice-grade telephone lines]. People wishing to access the UTCS network using this service may do so by dialing 978-7220.

The modems used in this service have a constant speed interface which has been set to communicate at 9600 bps. As a result, there are two minor differences between this service and the other UTCS dial-in services. First, when a connection is initially established, the connect message prompt "...SERVICE?" is immediately issued; you do not have to press the Return or

Enter keys to autobaud the system. Secondly, because the connection will always appear to the services on the UTCS PACXNET as being at 9600 bps, connections can only be made to services on the network which will support this connect speed.

The new modems support transmission error correction using the Microcom Networking Protocol (MNP) Class 5. The UTCS modems will support both MNP and non-MNP (non-error corrected) connections. The MNP error-correction protocol is upwardly compatible with all lower MNP classes. Modems supporting the MNP protocol will automatically negotiate to the highest mutually-supported error-correction level.

If you require assistance, contact the UTCS Advising Office at 978-HELP.

Correction

In the May/June issue of *ComputerNews*, we did not publish the complete address information for Library Master.

The correct address is:
Library Master
Balboa Software Company
61 Lorraine Drive
Willowdale, Ontario
M2N 2E3
(416) 730-1890

ComputerNews regrets the error.

ComputerNews Back Pages

Maureen Monné
monne@vm.utcs.utoronto.ca

Due to the increased size of recent issues of *ComputerNews*, we have decided to print the comprehensive listings of on-line documentation, software support, site licenses, and so on, on a thrice-yearly basis instead of in each issue. This will allow us to print more pages of hardware and software information, and thus keep you more up to date with what is under development or

ready for release.

You can look forward to seeing the back section in its entirety in the April, September, and November/December issues of *ComputerNews*. Should you have any questions about content changes between publication dates, just call the number listed in the section which interests you, or call 978-4990 for general information.

SAS News

Sandra Gardner
sgardner@vm.uts.utoronto.ca

SAS Institute Inc. has recently released SAS/PC version 6.04, which is an upgrade from the current version, 6.03. SAS/PC now offers IBM VGA support, new graphics device drivers, and dBase IV support. There are two new SAS/STAT procedures, namely, PROC CALIS for linear structural equation models, and PROC LOGISTIC for linear logistic regression models. The upgrade kit also contains fixes for many top-priority release 6.03 software bugs.

Two technical reports (P-200 and P-201) document the enhancements in release 6.04; you can purchase them from UTCS. If you have any questions about these enhancements, please call Sandra Gardner at 978-5128.

When you renew your current site licence, you may upgrade to version 6.04 (basic renewal costs \$70.00; additional modules cost extra). If you wish to upgrade your current version of SAS, or install for the first time, please call the UTCS Information Office at 978-4990 to obtain a copy of the registration contract and/or arrange to book the diskettes.

Site License Renewals: SAS & SYSTAT

SAS and SYSTAT users are reminded that their annual licenses expired June 30, 1990.

To ensure continued use of either package, return your completed 1990/91 registration contract as soon as possible. If you have not received renewal information, contact the UTCS Information Office at 978-4990.

SYSTAT News

Sandra Gardner
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SYSTAT Inc. has recently released SYSTAT 5.0 for the Macintosh. It features a complete Mac interface with dialog boxes and pull-down, tear-off hierarchical menus. Brushing tools that highlight cases in the graphics view window, as well as in the data editor window, are available for scatterplots. SYSTAT 5.0 also has the ability to spin three-dimensional scatterplots.

SYSTAT 5.0 is now included in the UTCS site license for SYSTAT. The software is available for the annual fee of \$100; the manuals cost \$58. Please review the hardware requirements below to see if your Macintosh can support SYSTAT 5.0. SYSTAT 3.2 will still be available to those who cannot install SYSTAT 5.0.

If you wish to upgrade your current version of SYSTAT, or install for the first time, please call the UTCS Information Office at 978-4990 to obtain the registration contract. To obtain the software, please bring five formatted diskettes to the Information Office at 4 Bancroft Avenue, Room 201, together with the completed registration contract.

SYSTAT 5.0

Hardware Requirements:

Macintosh with 4 Megabytes of RAM, a hard disk drive, and System 6.0 or higher.

No Coprocessor Version:

For use on Mac SE or Plus. Can run with 68020, 68030, 68881, or 68882 coprocessors, but does not take advantage of the coprocessor.

Coprocessor Version:

For use on Mac II or SE/30. Requires 68020, 68030, 68881, or 68882 coprocessor.

SYSTAT 3.2

Hardware Requirements:

Macintosh with 1 Megabyte of RAM (2MB for a Mac II), two 800KB disk drives or one 800KB drive and a hard disk.

No Coprocessor Version:

No special requirements.

Coprocessor Version:

Requires the 68020 processor and the 68881 coprocessor.

GRAFTOOL

GRAFTOOL is a menu-driven graphics package aimed at scientists and engineers. Besides offering the

Additionally, **GRAFTOOL** contains a spreadsheet to simplify data modification or creation. The

spreadsheet has some special features to facilitate typical

A Scientific Graphics Package

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full range of features required for all users, it also provides a number of specialized options, to be discussed below. Despite the number of features available, the program's menu structure is relatively simple, and actually quite transparent. After only a short session with the manual, I could move around the menu system confidently.

GRAFTOOL supports thirteen basic graphs, each with many options that give you the flexibility to customize the graph. After you have created a graph and customized it, you can save your work in a display control file (with extension .DCF) to review it and modify it at a later time. There are three fonts available for text as well as the Greek alphabet for symbols.

A number of analysis and data processing functions are available once you have placed data on the graph(s). You can store the results of processing in a file, so the data, together with any calculated parameters, can be saved for future use. While the file is still open, the new data can be displayed on the same graph along with the original data or by itself.

tasks, like coordinate conversion.

GRAFTOOL also allows you to build a series (called a "reel") of bit-mapped display images that can be called to the screen in sequence and displayed rapidly. This feature, called "Slide Show," can be useful when you have time-varying data or graphs that require a long time to plot. Displaying a bitmapped image is quite fast, particularly if you save the image on a RAM disk.

Figure 1 shows the Main Screen of **GRAFTOOL**. It consists of five display areas: the graph area, the command area, the view area, the status area, and the data readout area. The graph area contains your graphs and text. Sometimes you see pop-up dialog boxes there. They appear in the graph area when additional input is required for certain commands. In *Figure 1*, the graph area contains two graphs placed beside each other: a three-dimensional (3D) surface graph and the contour plot of this surface. The contours were obtained from the surface data using the contouring option of the program; the number of contour levels was chosen by the user (ten in this case). The contours

Numerical and Scientific Software

are marked with the values of the z variable they correspond to, but the actual numbers are too small to be seen. If you zoom into the contour plot on the screen, you can see them. The command area contains a menu of commands you can use to control program execution. These commands are described below. The view area provides information on either the current zoom location or object rotation angles, depending on the operation being performed. For instance, in *Figure 2*, the view area shows what part of the graph is visible in the graph area after zooming in. The status area is the line at the bottom of the screen that contains all the prompts, messages, errors and/or hints that may result from your actions. The data readout area, visible in *Figure 2*, is displayed during operations requiring the data cursor, including data processing and analysis operations.

The commands shown in the command area perform the following actions:

- *Add* adds another graph to the graph area. The following types of graphs are supported by the program:

- Bar Chart (horizontal bars)
- Column Chart (vertical bars)
- Eye Diagram (like x-y plot, but with modular wrap-around for horizontal axis)
- Histogram (for both one and two variables)
- Parametric (set of three graphs — x - y , x - t , and y - t — when x and y depend on time)
- Pie Chart
- Polar Chart
- Smith Chart (used in electromagnetics and transmission line computations)
- Surface Plot (includes 3D trajectory plots)
- Topographic (basically contour plots)
- Transfer Plot (a set of three related two-dimensional plots, used to analyze the effects of a memoryless function on an input data set)
- X-Y Plot
- *Change* allows you to modify objects visible in the graph area: graphs, labels, text and arrows. Modifications include changing position, orientation, size, fonts, and other features.
- *Data* is used to manipulate data. This includes data processing and analysis, and reading data values from the screen (see *Figure 2*). This command is also used to create or modify data by invoking the spreadsheet module.
- *Erase* removes objects from the graph area.
- *File* changes the default directory, erases files, and saves and loads display control (.DCF) files. A .DCF file contains all the information about contents of the graph area. When you save it and load it later, you can recreate the graph.
- *Library* allows you to save your graph in your own customized library of graphs. This is used when you regularly create similar graphs, and want to avoid repeating the same definitions every time.
- *Options* sets the fonts to be used for the screen and output device, and

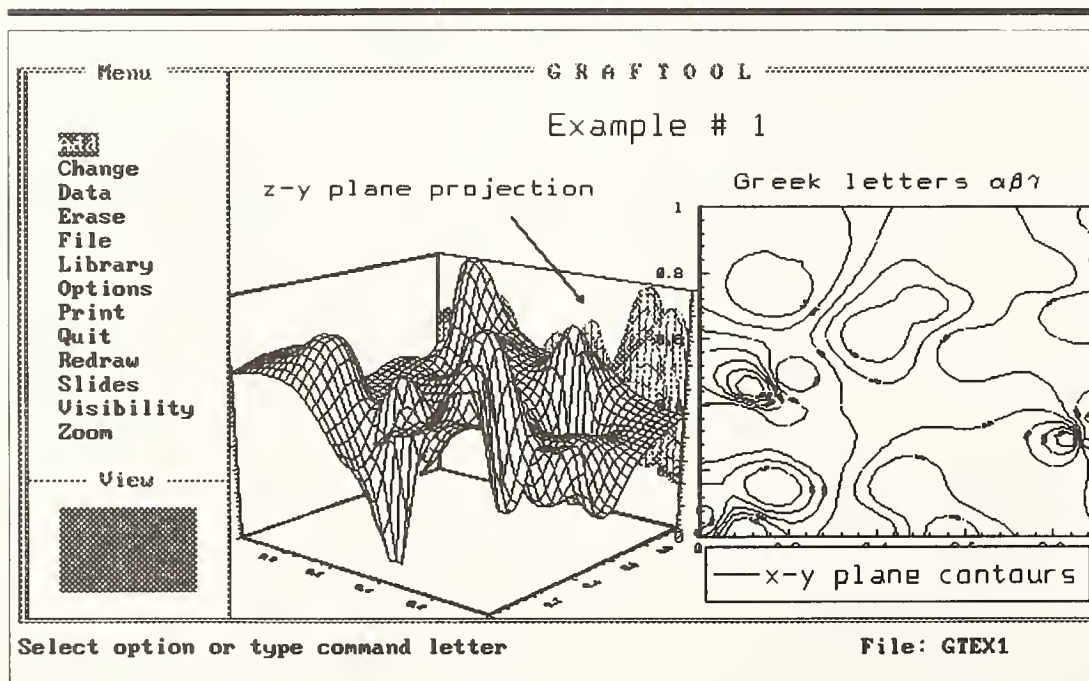


Figure 1: Main screen of GRAFTOOL. The graph area shows two graphs: a surface graph with projection of the surface onto a z - y plane and a contour graph. The figure also illustrates some other objects which can be placed on a graph, like arrows, legends, text, and Greek letters.

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determines whether you want to use Auto-Redraw (automatic refresh after modification), and Auto-Backup (automatically generating backup files).

- *Print* is used to create a hard copy of your work on a printer or plotter. You can send your graph either directly to a printer (a driver for the Epson dot matrix printer is available), or save your file in HPGL format or PostScript format. (See discussion below.)
- *Quit* returns you to DOS, prompting you to save your work in case you have not done so since the last modification.
- *Redraw* erases the screen and redraws all objects. This is used when Auto-Redraw is off.
- *Slides* is used to create or access bitmapped slides of the screen.
- *Visibility* allows you to change the order in which objects are drawn on the screen, thus changing the visibility of overlapping objects.
- *Zoom* allows you to zoom in on or pan objects in the display.

GRAFTOOL reads only ASCII data, but gives you a certain amount of flexibility in specifying how the individual data sets and/or columns of numbers are to be used. The spreadsheet module sometimes may be helpful in arranging the data to make it conform to GRAFTOOL's requirements.

The program can handle up to 100 data files. Curves may have up to 65536 points, and surfaces may have up to 65536 x-values (rows) and 4096 y-values (columns). However, for the purpose of processing, only 4096 rows are allowed. This limit also applies to the spreadsheet module.

The following types of data processing and analysis are supported by the program:

- weighted and uniform smoothing;
- regressions: linear, polynomial (the smooth curve in *Figure 2* was obtained by third order polynomial regression), exponential, Fourier, geometric and hyperbolic; in each case, you have a fair amount of flexibility in determining the relevant parameters;
- interpolation;
- Fourier transforms, forward and inverse;

- scaling and biasing;
- contouring surfaces and 3D histograms;
- extracting and copying data.

There is a choice of linear, logarithmic or probabilistic axis (the latter are used in probability theory and in statistical analysis). The numbers (and text, if referring to a bar chart or column chart) may be parallel to the axis, perpendicular to the axis or slanted at a 45-degree angle.

For the purpose of producing a hard copy of your graph, the program offers device drivers for a large variety of printers (AT&T, C.Itoh, various Epsoms, HP Laser-Jets and PaintJets, IBM, Okidata, Genicom and Panasonic) and several plotters (FACIT, HP, IBM, and ZETA). There is also a program included to help you to create a custom printer driver, in case you have an unsupported hard copy device.

I have tested the Epson driver. The program supports also HPGL and PostScript graphics files, a feature which I have checked. The quality of the graphs produced this way is very good (*Figures 1 and 2*

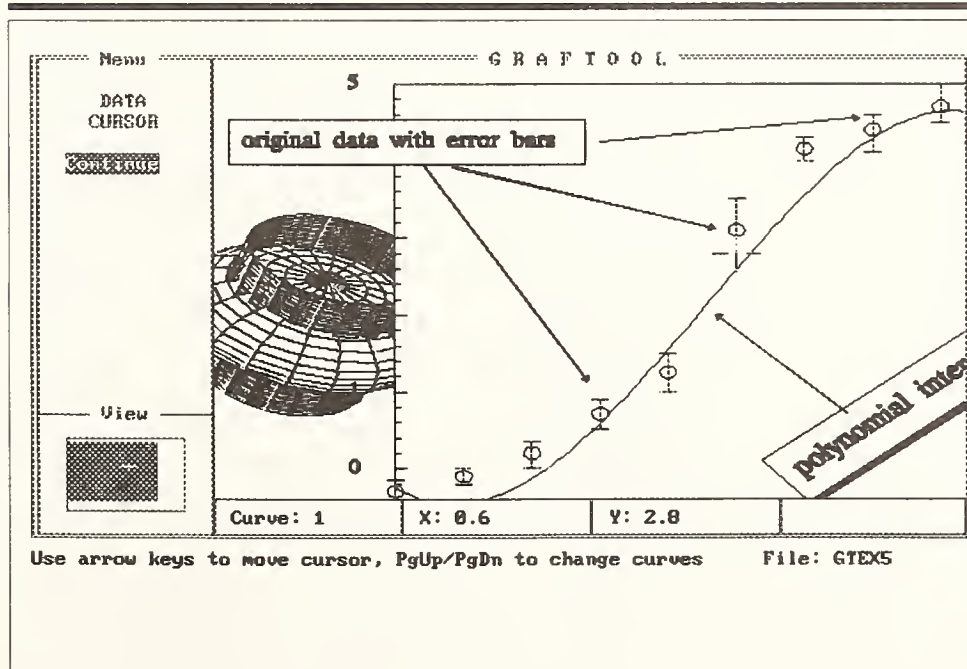


Figure 2: X-Y graph of data points with error bars. The figure illustrates the zoom-in feature of the program. The view area (bottom left) shows the portion of the original graph area visible at this moment. You can use the data readout area (at the bottom of the graph area) to examine data points. The object at the left margin of the graph area demonstrates the program's ability to draw closed surfaces, but also shows that the algorithm used to draw intersecting surfaces is not without problems.

Numerical and Scientific Software

were produced with HiJaak, a screen-capture program, and do not do justice to the graph quality GRAFTOOL can give you).

Another nice feature of GRAFTOOL is its ability to draw closed surfaces, as seen in an insert in *Figure 2*.

Although GRAFTOOL generally performed very well, I did run into several small problems:

1. As shown in *Figure 1*, you can draw error bars on data points. However, you can mark the data points only with circles. If you are displaying two sets of data, error bars with identical markers could cause some confusion. Additionally, when you move the cursor through the data points, only the lower limits of the error bars are sampled (see *Figure 2*).
2. Although GRAFTOOL can draw several intersecting surfaces while removing hiding lines, the algorithm used for this purpose sometimes runs into problems, as seen in *Figure 2*.

3. There are problems with hard copies of graphs. If a graph's frame is not completely visible within the graph area, as in *Figure 1* and *Figure 2*, superfluous lines appear on the graph. These are not seen on the screen, only on hard copies of the graphs and, hence, must be due to a bug in the device drivers.

4. Within the spreadsheet module, the only way to specify a cell is to move into this cell using the arrow keys, PgUp, PgDn or Tab keys — you cannot type the cell address. For large amounts of data, this may be very cumbersome and slow. Also, since columns are designated by combinations of letters, trying to figure out from the column name what number it corresponds to is awkward. This problem also exists in Lotus 1-2-3, but has been addressed in Microsoft Excel.

In brief, despite some small problems, I find GRAFTOOL to be a very good, although expensive,

graphics package for scientific and engineering applications. It is easy to use, friendly, and offers nearly everything you might need.

I would like to acknowledge cooperation of the vendor, 3-D Visions Inc., who provided me with a complimentary copy of the package.

Hardware Requirements:

IBM Personal Computer or compatible;
640KB RAM, hard disk, DOS 3.0 or higher.

Vendor:

3-D Visions, Inc.
412 S. Pacific Coast Highway
Second Floor
Redondo Beach, CA 90277
USA
(213) 540-8818

Price:

US\$495 (academic discounts available)

New SAS/GRAPH Seminar!

During this seminar, SAS/PC users will be introduced to SAS/GRAPH, SAS' high resolution graphics package. If you licensed SAS/PC from UTCS, you were provided with the SAS/GRAPH software as part of the basic SAS package. This seminar has been designed to help those of you who have installed SAS/GRAPH but have never used any of the procedures. The following topics will be covered in the course:

Software considerations: SAS/GRAPH versus other graphics packages - advantages and disadvantages; a review of the types of graphs that can be produced by SAS/GRAPH (procedures GCHART, GPLOT, GSLIDE, G3D, and GMAP); enhancing graphs (statements TITLE, FOOTNOTE, PATTERN, SYMBOL, AXIS, and LEGEND).

Hardware considerations: how to set up SAS/

GRAPH for your monitor, printer, or plotter (procedures GDEVICE and GTESTIT). Includes a discussion on how to create a graphics stream file.

Graph management: how to save graphs permanently and display them at a later date (procedure GREPLAY). Includes a discussion about SAS catalogs and SAS libraries.

Advanced topics: how to display multiple graphs on a page (procedure GREPLAY); how to annotate your graphs (ANNOTATE data sets).

Class size is limited in this hands-on course. Please contact Irene Rosiecki at 978-4565 to find out about dates and times, and to find out about registration procedures. Courses are filled on a first-come, first-served basis.

Prerequisite: Introduction to SAS or equivalent experience with SAS.

Chaos in the Classroom II: Fractals and Julia Sets

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Dynamical Systems Inc. has finally released the second educational program in its **Chaos in the Classroom** series. **Fractals and Julia Sets** allows you to investigate the Mandelbrot set, Julia sets, and the related dynamics.

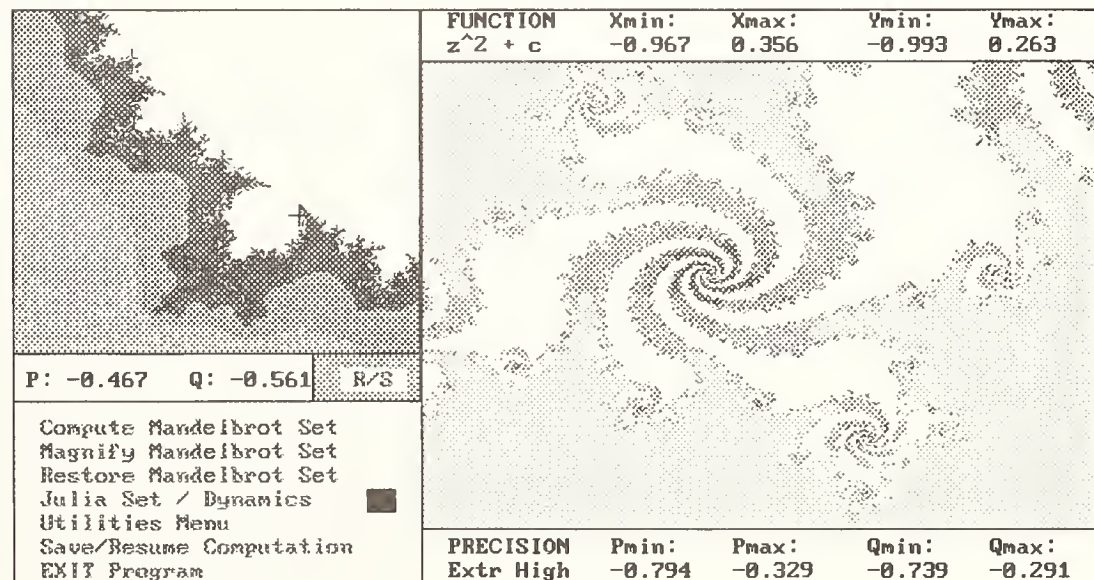
The program is fully menu-driven and supports a Microsoft or Microsoft-compatible mouse. If you do not have a mouse, you can use a program included in the package to use the Arrow, Insert, and Delete keys to emulate a mouse.

As *Figure 1* shows, the program's screen consists of three main areas: the Mandelbrot set window in the upper left corner, the Julia set window that occupies most of the screen, and the Main Menu area in the lower left corner.

The menu options in the Main Menu area invoke the following tasks:

- *Compute Mandelbrot Set* redraws the picture in the Mandelbrot window. Usually you exercise this option if you want to change the precision or computational algorithm.
- *Magnify Mandelbrot Set* allows you to magnify the parameter space. You have to mark the region you want to magnify by pointing to the upper left and lower right corners of the area with the cursor. After you have made your choice, the box is delineated and you can either accept it or repeat the process of marking the corners to select a different area. The Mandelbrot window in *Figure 1* shows a magnified part of the Mandelbrot set.
- *Restore Mandelbrot Set* allows you to restore either the initial display or the magnification preceding the current display.

Figure 1:
 A view of the CITC II screen displaying a magnified fragment of a Julia set. The Mandelbrot set window (in the upper left corner of the figure) shows a magnified portion of the Mandelbrot set, with a cross marking a point in the parameter space for which the Julia set is constructed.



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- *Julia Set/Dynamics* leads to a submenu for constructing Julia sets and investigating the underlying dynamics. To construct a Julia set, you first have to choose a point in the parameter space. You do this with the cursor in the Mandelbrot window. The selected point is marked with a cross, as illustrated in the Mandelbrot window in *Figure 1*. As in the case of the Mandelbrot set, you can also decide on the precision of the calculations. After the Julia set has been displayed in the main window, you can magnify a portion of it (by choosing the desired region in the same way as in the case of the Mandelbrot set), repeat the calculations with a different precision, or visualize dynamics in the phase plane.
- *Utilities* offers the following choices:
 - a) two computational algorithms;
 - b) six levels of precision (increasing precision increments the number of times the complex logistic equation $z_{i+1} = z_i^2 + c$ is iterated, before the program assumes that the trajectory will not escape to infinity);
 - c) the ability to define or redefine a palette of colours used for coding different regions of the parameter space;
 - d) the ability to save the existing screen to a .PCX graphics file, which can be redisplayed at a later time.
- *Save/Resume Computation* allows you to stop a long computation and save the results obtained until this moment, so that the computation can be resumed at some later time. This is a very useful feature since some computations can be very time consuming. For instance, the enlargement of the Julia set shown in *Figure 1* took over four hours to compute on a Zenith 286 running at six megahertz (MHz) with a math coprocessor. On a slower computer, a math coprocessor is crucial to ensure an acceptable running speed. I also tried the program on a Zenith 386 (running at 33MHz) without a math coprocessor, and the speed was comparable with the aforementioned Zenith 286 with a math coprocessor.

The figure in this article was created by saving the screen to a .PCX file. This file was transformed into a TIFF file using a screen-capture program called HiJaak, so that the image could be imported into our desktop publishing software package. On a colour screen, the figure looks much more impressive, of course.

The program comes with a 60-page manual that describes the menu structure in detail, and gives a good, elementary mathematical overview of

dynamical systems, fractal geometry, and the relation between them. For users not satisfied with the level of the overview, a large number of references to original papers is included. Some aspects of the program's operation are not, however, explained in sufficient detail. For instance, nowhere could I find how the different levels of precision relate to the number of iterations performed by the program.

Hardware Requirements:

PC, XT, AT or a 386 system;
512KB of RAM;
EGA or VGA graphics (colour or mono);
Runs under DOS or OS/2 in DOS window;
Math coprocessor and hard disk strongly recommended.

Vendor:

Dynamical Systems, Inc.
P.O.Box 35241
Tucson, Arizona 85740
USA
(602) 292-1962

Price:

US\$59.95

Free NetNorth (Electronic Mail) Demonstration

August 17, 1990

1:00 -3:00 p.m.

Anyone interested in sending documents to colleagues or friends reliably, quickly, and inexpensively will not want to miss this demonstration. We will introduce you to the NetNorth/BITNET/EARN communications network, which is accessible from the CMS system. This network connects more than a thousand universities and research institutes in Europe, Asia, and North America. Sending documents or files over the network is very easy to learn.

We will show you how to send mail and files to another institution, and how to talk directly to someone on the network. **Please note this is a demonstration only.**

Space is limited. If you would like to attend one of these sessions, please contact Irene Rosiecki at 978-4565 to reserve a place.

Microcomputer Short Courses

Irene Rosiecki
rosiecki@vm.utcs.utoronto.ca

UTCS offers various noncredit microcomputer courses to faculty, staff, and graduate students of the University of Toronto. These courses cover a number of software programs available for the PC or the Macintosh. Whether you will be typing a thesis on a word processor, or working with spreadsheets, databases, or desktop publishing, we may be able to help you get started.

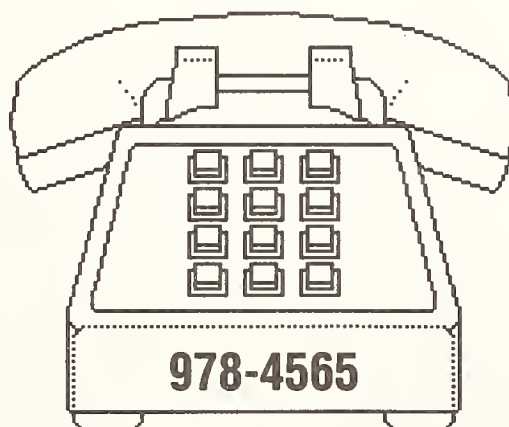
Our class sizes are small to allow for much individual attention. Continuing support is available upon completion of a course.

The following is a list of the microcomputer courses taught at UTCS:

- | | |
|---|--|
| <ul style="list-style-type: none">• Introduction to dBASE IV• Introduction to Desktop Publishing• Introduction to Disk Operating System (DOS)• Electronic Mail Seminar• Excel on the Macintosh• Introduction to FoxBASE+/Mac 2.0• Introduction to HyperCard• Introduction to Lotus 1-2-3• Introduction to PageMaker | <ul style="list-style-type: none">• ProComm Communications Seminar• Introduction to SAS on the PC• Intermediate SAS – Data Processing• Intermediate SAS – Statistics• Microsoft Word on the Macintosh• Microsoft Word on the PC• Introduction to WordPerfect 5.1• Advanced WordPerfect 5.1 Topics• Introduction to WordPerfect 5.1 for 5.0 Users |
|---|--|

To find out about course dates and registration procedures, or to book a place in any of these courses, please contact Irene Rosiecki at 978-4565. Courses are filled on a first-come, first-served basis. The more popular courses fill up quickly, but waiting lists are maintained in case of cancellations.

***Call now for
registration
information!***



Facilities Managed by UTCS

Administrative Computing

- administrative IMS, DB2, Batch, and TSO
- 3081K processor, 48 megabytes of memory
- MVS/XA operating system

Computer Disciplines Facility/UNIX

- SUN 3/280s, 16 megabytes of memory (zero.cdf)
- Computer Science interactive access
- SUN UNIX 4.0.3

SUN 3/280s, 16 megabytes of memory (one.cdf)

- Computer Science interactive access
- SUN UNIX 4.0.3

Computer Disciplines Facility/PC

- 40 NEC computers connected in a Local Area Network
- 66 TI Professional Computers connected in a Local Area Network
- introductory Computer Science instruction
- MS-DOS with Turing environment

Erindale College Systems

- SUN 3/280, 16 megabytes of memory
- instructional and research access using UNIX

VAX 8200, 8 megabytes of memory

- instructional access using VMS
- research access

VAX-11/750, 5 megabytes of memory

- instructional access using UNIX (Berkeley UNIX 4.3BSD)

Institutional Relations System

- VAX-11/750, 8 megabytes of memory
- database services to the owner departments using VMS

EPAS Facility

- 4361-5 processor, 16 megabytes of memory
- general VM/CMS services to the owner departments

Ontario Centre for Large Scale Computation (OCLSC)

- Cray Research Inc. X-MP/24
- 2 processors, 4 megawords main memory
- solid state disk (SSD) with 64 megawords of storage
- COS 1.17 operating system
- VAX 8350 + MicroVAX II and VAX750 provide

The mandate of UTCS is to encourage and support the use of information technologies across campus, and to plan, implement, and operate common-carrier networks and certain appropriate central computer facilities.

UTCS Centrally Owned and Managed

Systems

IBM VM/CMS

Technical Assistance: 978-6602

- General Purpose Timesharing environment
- Hub of the NetNorth network with access to BITNET, EARN and the Internet
- 4381-R02 processor with 32 megabytes of memory
- CP operating system, VM/SP HPO R5
- CMS timesharing system, VM/SP Release 5
- FTP and TELNET access to the campus ethernet, as well as Internet
- RSCS spooling system, Release 2.3

GP UNIX

Technical Assistance: 978-8853

- General Purpose Timesharing under SUN UNIX 4.0.3
- SUN 3/280, 16 megabytes of memory
- access to Linotronic typesetter
- offers a sophisticated and powerful environment for text processing
- offers a sophisticated programming environment suitable for commercial software development or testing
- full access to USENET, an electronic technical information exchange facility
- offers excellent electronic mail facilities and ability to send or receive mail from most computer networks worldwide, such as UUCPNET, ARPANET, NetNorth, BITNET, CSNET, CDNNET

Services

Communications, Networking & Technical Support

Primary Phone: 978-7087

- Communications Group provides communications systems, terminals, modems, data channels: consulting and installation.
- Field Service Group installs and maintains communications and computer systems, particularly IBM PCs and Macintoshes, on a contract basis or on a cost-per-call basis.
- provides consulting on computer systems technology and installs computer systems
- provides access between the IBM systems and machines using UNIX, VMS and other operating systems. Ethernet, Pronet, and IBM TRN technologies are used over various transmission media including optical fibre. More basic communications techniques are also used for moderate speed links.
- provides consulting on local area networking and installs LANS
- provides access to NetNorth (BITNET), the North American Universities Network; ONET, the Ontario Regional Network; CA*net, the Canadian National Network; and USENET, the UNIX networking fraternity
- provides gateway to the US Internet
- will provide a communications solution to department needs on a contractual basis

Information Centre

Primary Phone: 978-HELP

- Provides assistance in use of electronic messaging, including use of Local Area Networks (LANS); NetNorth/BITNET/EARN, the world Universities network; CDNNET, the Canadian X.400 network; ARPANET; CSNET; USENET; and other international connections.
- provides advising, consulting and documentation on:
 - command languages, including CMS and UNIX
 - high-level languages, including FORTRAN, and C
 - packages and libraries, including SAS, SPSS, BMDP, IMSL, and NAG
 - editors and formatters, including XEDIT, ed, nroff/troff
- provides general micro support
- selection consulting for hardware and software
- Micro Lab for evaluation of hardware and software
- advice on University discounts
- media conversion and data transfer
- CD-ROM access to software and information discs
- offers PostScript Laser Printing Service
- offers 35mm slide production service using Polaroid Palette
- administers Local Area Network of PCs for Education Facility
- administers Macintosh Education Facility
- high-quality typesetting
- provide image and typed text scanning
- installs and maintains application packages
- administers site licenses for various software packages

Consulting and Enquiries

Applications Support & Advising Supervisor	Alex Nishri	BC214	978-7109
External Marketing Consultant	Ihor Prociuk	BC217	978-6875
Erindale College	Joe Lim	ER2035	828-5311
Information Office	Evelyn Ward	BC201	978-4990
Account & Access Code Enquiries	Sylvia May	BC101B	978-7148
IBM & Macintosh Maintenance	Kam Mark	BC103	978-5050
Tape Library (Academic Services)	Susan Kovago	MP368	978-7319
Tape Library (Administrative Services)	Miranda Fong	MP368	978-6693
Communication, Networking & Hardware	Rosi Derka-Tseu	BC105	978-7087
UTCS Noncredit Short Courses	Irene Rosiecki	BC217	978-4565

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CMS Userid for mail problems:	POSTMSTR
Network Operations Centre	978-4621
System Status Enquiries (GP UNIX)	978-4318
System Status Enquiries (IBM)	978-7393
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Interactive Services 1200 (bps)	978-3959
Interactive Services 2400 (bps)	978-7239
Interactive Services 9600 (bps)	978-7220

UTCS Directory

Director:	Dr. Warren Jackson	BC118	978-8948	wcj@vm.utcs.utoronto.ca
Associate Director:	Eugene Siciunas	BC116	978-5058	eugene@vm.utcs.utoronto.ca
Managers:				
Communications & Technical Support	Norman Housley	BC121B	978-4967	norman@vm.utcs.utoronto.ca
Information Centre	Don Gibson	BC217	978-7331	don@vm.utcs.utoronto.ca
Internal Systems Support	Ron Vander Kraats	BC121A	978-4428	rvk@vm.utcs.utoronto.ca
Operations Support	Dr. Bob Chambers	MP350	978-7092	
Systems Support	Bill Lauriston	MP331	978-3579	bill@vm.utcs.utoronto.ca

Committees on Computing

Supercomputer Users' Group at U of T	Chair	Prof. W.R. Peltier	978-2938
Research Board Standing Committee on Computing	Chair	Prof. C.C. Gotlieb	978-2986

Legend:
 BC = Bancroft Building
 ER = Erindale
 MP = McLennan Physical Labs

* NetNorth/BITNET/EARN

Names and Locations

Central Advising Office (CAO), 978-HELP
 Engineering Annex (EA, CDF), 11 King's College Road, Rooms 103, 107, 107B, 201, 203
 Erindale College (Erin), 828-5339, 3359 Mississauga Road North, Erindale Campus, Rooms 2037, 2039A-B-C, 2045
 Ramsay Wright, 25 Harbord St., Rooms 211, 212, 213
 Roberts, Roberts Library, 130 St. George St., Room 1061A
 Sidney Smith (Sidney), 100 St. George St., Room 1071
 St. Michael's College, 121 St. Joseph St., Room 107
 Trinity College, 6 Hoskin Ave., Room 024
 Victoria University, 73 Queen's Park Cres., Room 208

Access Hours

Sites	Hours of Access				Restrictions* Advising	
	Mon-Thurs	Fri	Sat	Sun		
CAO	10:00-18:00	10:00-18:00	closed	closed	Research	978-HELP
CDF	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	No
EA	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Erin (2039)Δ	9:00-17:00	9:00-17:00	12:00-16:00	12:00-16:00	Research	Rm 2005
(2045-46-47)	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	Rm 2005
(235)†	8:00-22:00	8:00-17:00	closed	closed	None	Rm 2046
Roberts	8:30-24:00	8:30-24:00	9:00-22:00	13:00-22:00	None	978-HELP for Research
Sidney	7:00-24:00	7:00-24:00	7:00-24:00	7:00-24:00	None	978-HELP for Research
St. Michael's	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Trinity	8:00-22:00	8:00-22:00	8:00-22:00	8:00-22:00	None	978-HELP for Research
Victoria	8:30-21:00	8:30-21:00	8:00-13:00	8:00-13:00	None	978-HELP for Research

Sites	Advising Hours
CAO	Monday through Friday, 10:00 - 18:00
Erin	Monday through Friday, 09:00 - 22:00

Legend

- * Research includes graduates, faculty, staff.
- Δ Key access available.
- † Access restricted to building hours.

Computer and Printer Access

Sites	PACX	Printers	CDF/PC Microcomputers	CQUEST Workstations
CDF	N	Y	N	
EA	Y	Y	N	
Erin	Y	Y	N	
Ramsay Wright		Y**		Y
Roberts	Y	Y	Y†	
Sidney	N	Y	Y††	Y
St. Michael's	Y	Y	Y††	
Trinity	Y	Y*	Y††	
Victoria	Y	Y*	Y††	

(Y=yes, N=no)

* CDF PC only

** Site Only

† NEC

†† TI PC

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